



United States
Department of
Agriculture

Forest Service

Allegheny
National Forest

March 2007



Allegheny National Forest

Final Environmental Impact Statement

To Accompany the
Land and Resource Management Plan



This document is available in large print.

Contact the Allegheny National Forest

Supervisor's Office

1-814-723-5150

TTY 1-814-726-2710

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Cover photo: Allegheny River Islands, R Hokans, photographer

Final Environmental Impact Statement

To Accompany the
Land and Resource Management Plan

Allegheny National Forest

March 2007

Elk, Forest, McKean, and Warren, Counties, Pennsylvania

Lead Agency:

USDA Forest Service

Responsible Official:

Randy Moore, Regional Forester
Eastern Region Office
USDA Forest Service
626 East Wisconsin Avenue
Milwaukee, WI 53202
414-297-3765

Information Contact:

William Connelly, Planning Officer
Allegheny National Forest
Supervisor's Office
222 Liberty Street
Warren, PA 16365
814-723-5150

Abstract: This Final Environmental Impact Statement (FEIS) documents analysis of four alternatives developed for programmatic management of the 513,000 acres administered by the Allegheny National Forest. Alternatives A, B, Cm, and D were analyzed in detail in this FEIS. Alternative Cm is the preferred alternative and was the foundation for the Revised Land and Resource Management Plan.

This FEIS documents the analysis of all alternatives and displays the environmental effects at a programmatic level. The preferred alternative, outlined as the ANF Revised Land and Resource Management Plan, guides all natural resource management activities on the ANF; addresses new information and concerns raised since the 1986 Forest Plan was published; and meets objectives of federal laws, regulation, and policies.

Availability of the FEIS is published in the Federal Register.



Contents

Summary of the FEIS.....	Summary-1
FEIS Preface	Preface-1
Chapter 1—Purpose, Need, and Public Involvement.....	1-1
Chapter 2—Alternatives	2-1
Chapter 3—Affected Environment and Environmental Consequences	3-1
Chapter 4—List of Preparers	4-1
Chapter 5—Environmental Impact Statement Recipients	5-1
Chapter 5—Glossary	6-1
Chapter 7—Reference List	7-1
Chapter 8—Index	8-1

This page intentionally left blank.

Summary of the FEIS Table of Contents

PURPOSE AND NEED	SUMMARY - 1
Introduction	Summary - 1
Purpose and Need for Change	Summary - 1
Proposed Action	Summary - 1
Forest Plan Decisions	Summary - 2
Public Involvement and Collaborative Planning	Summary - 2
Issues.....	Summary - 2
Forest Vegetation Management	Summary - 3
Habitat Diversity	Summary - 3
Recreation and Special Areas	Summary - 4
Other Planning Areas	Summary - 4
ALTERNATIVES	SUMMARY - 5
Introduction	Summary - 5
Changes to Alternatives between DEIS and FEIS	Summary - 5
Elements Common to all Alternatives	Summary - 6
Alternatives Considered in Detail	Summary - 6
Alternative A: Continuation of the 1986 Forest Plan	Summary - 6
Alternatives B, Cm, and D: Modification of the 1986 Forest Plan	Summary - 7
Alternatives Considered but Eliminated	Summary - 9
Selected Alternative	Summary - 10
Comparison of Alternatives.....	Summary - 11
Oil and Gas Development	Summary - 11
ENVIRONMENTAL CONSEQUENCES	SUMMARY - 15
Introduction	Summary - 15
Vegetation Management	Summary - 15
Forest Composition.....	Summary - 15
Forest Age.....	Summary - 16
Forest Health.....	Summary - 16
Land Suitable for Timber Production	Summary - 17
Allowable Sale Quantity.....	Summary - 20
Habitat Diversity	Summary - 21
Landscape Patterns	Summary - 22
Management Indicator Species	Summary - 23
Game Species	Summary - 25
Species with Viability Concerns.....	Summary - 25
Recreation.....	Summary - 28
Special Areas.....	Summary - 30
Other Effects	Summary - 33

LIST OF TABLES

Table 1. Management Area Allocation by Alternative (Acres)	Summary - 12
Table 2. Past Management Activity Levels and Future Projected Management Activities (Annual Average/Year) by Alternative.....	Summary - 13
Table 3. Lands tentatively suitable for timber production	Summary - 18
Table 4. Suitable Land for Timber Production (acres)	Summary - 19
Table 5. Percent of Remote Habitats Retained	Summary - 23
Table 6. Acreage managed with an emphasis on core areas and connectivity	Summary - 23
Table 7. Suitable Goshawk Nest Habitat by Alternative	Summary - 24
Table 8. Mourning warbler habitat by Alternative, 2060	Summary - 26
Table 9. Viability Outcomes: Direct and Indirect effects of alternatives	Summary - 29
Table 10. Cumulative viability outcomes by alternative	Summary - 29
Table 11. Non-motorized recreation opportunities by alternative	Summary - 31
Table 12. Acres allocated to IUAs by alternative	Summary - 32
Table 13. Equestrian use opportunities by alternative.....	Summary - 32
Table 14. Potential economic impacts	Summary - 40

LIST OF FIGURES

Figure 1. Forest types, current and estimated, 2060	Summary - 15
Figure 2. Age Class Outcomes by the Sixth Decade	Summary - 16
Figure 3. Allowable Sale Quantity	Summary - 20
Figure 4. Percent of forest land by structural habitat diversity by alternative, 2060.....	Summary - 22
Figure 5. Cerulean Warbler Habitat by Alternative in the Year 2060	Summary - 25
Figure 6. Wilderness and wilderness study area recommendations	Summary - 35

FEIS Table of Contents

PREFACE	PREFACE-1
Organization of the Final Environmental Impact Statement	Preface-1
Forest Niche/Historical Perspective	Preface-3
The Allegheny Today.....	Preface-3
A Vital Watershed	Preface-3
A Home to Native Plants and Animals.....	Preface-3
A Place to Play	Preface-4
Working Woodland	Preface-4
The Research and Experimental Forest	Preface-5
Planning Laws.....	Preface-5
Allegheny National Forest at a Glance	Preface-6
1 PURPOSE, NEED, AND PUBLIC INVOLVEMENT	1-1
1.1 Purpose	1-1
1.2 Need for Action.....	1-1
1.2.1 Vegetation Management Need For Change	1-1
1.2.2 Habitat Diversity Need For Change	1-2
1.2.3 Recreation and Special Area Designations Need For Change	1-2
1.2.4 Other Resource Areas	1-2
1.3 Scope of Plan	1-3
1.3.1 Items Outside the Scope of the Plan That Do Not Constitute a Need For Change	1-3
1.3.2 Items Within the Scope of the Plan That Are Not Addressed	1-3
1.3.3 Items within the Scope of the Plan that are Addressed	1-4
1.4 Proposed Action	1-4
1.5 Decisions to Be Made	1-4
1.6 Public Involvement.....	1-5
1.7 Significant Issues	1-6
1.7.1 Forest Vegetation Management.....	1-6
1.7.2 Habitat Diversity	1-13
1.7.3 Recreation and Special Areas	1-17
1.8 Other Areas of Concern	1-21
1.8.1 Riparian Management.....	1-21
1.8.2 Soil Quality	1-21
1.8.3 Scenery Management.....	1-21
1.8.4 Transportation Systems.....	1-21
1.8.5 Monitoring	1-22
1.8.6 Management Areas	1-22
1.8.7 Social and Economic Contributions	1-22
1.8.8 Oil and Gas Management	1-22
2 ALTERNATIVES	2-1
2.1 Introduction to the Alternatives	2-1
2.2 Developing Alternatives.....	2-2
2.2.1 Alternatives Developed and Analyzed in the DEIS	2-2
2.2.2 Changes to Alternatives between DEIS and FEIS.....	2-2
2.3 Elements Common to Alternatives	2-4
2.3.1 Laws and Regulations	2-4

Table of Contents

2.3.2	Technical Information.....	2-4
2.3.3	Deer Management.....	2-5
2.3.4	Trail Management	2-5
2.3.5	Forest Health.....	2-5
2.3.6	Oil and Gas Development	2-5
2.3.7	Special Designations.....	2-5
2.4	Description of Alternatives, Including the Proposed Action and No Action.....	2-6
2.4.1	Alternative A: Continuation of the 1986 Forest Plan	2-6
2.4.2	Alternative B.....	2-8
2.4.3	Alternative C (modified) (Cm)	2-10
2.4.4	Alternative D.....	2-12
2.5	Description of Alternatives Considered but Eliminated from Detailed Study.....	2-14
2.5.1	Allegheny Wild! by the Allegheny Defense Project (ADP)	2-14
2.5.2	A Citizen's Wilderness Proposal for Pennsylvania's Allegheny National Forest by Friends of Allegheny Wilderness (FAW).....	2-27
2.5.3	Recreation and the Need to Increase Motorized Recreational Opportunities on the Allegheny National Forest by Allegheny Trail Riders.....	2-29
2.5.4	Multiple-Use and Sustained Yield by Allegheny Alive.....	2-30
2.5.5	Comments on Vegetation Management for the Allegheny National Forest Plan Revision by Allegheny Hardwood Utilization Group (AHUG).....	2-32
2.5.6	The Nature Conservancy (TNC).....	2-34
2.5.7	Local Government Resolutions.....	2-34
2.5.8	Other Alternatives Eliminated from Detailed Study.....	2-37
2.6	A Comparison of Alternatives	2-37
2.6.1	Management Area Allocation and Summary	2-38
2.6.2	Estimated Management Activities/Outputs	2-49
2.6.3	How the Alternatives Addressed the Issues (Display of Evaluation Criteria)	2-53
2.7	Identification of the Preferred Alternative.....	2-59
2.8	Estimation of Future Oil and Gas Development.....	2-59
3	AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES	3-1
3.1	Introduction to Affected Environment and Environmental Consequences	3-1
3.1.1	Relationship of Forest Plan Decisions to the Environment.....	3-1
3.2	Physical Environment: Direct, Indirect, and Cumulative Effects	3-3
3.2.1	Geology and Minerals.....	3-3
3.2.2	Soil Resources	3-7
3.2.3	Water Resources	3-22
3.2.4	Air resources.....	3-52
3.2.5	Transportation Resources	3-64
3.3	Biological Environment—Direct, Indirect, and Cumulative Effects	3-75
3.3.1	Forest Vegetation	3-77
3.3.2	Plant and Animal Habitats.....	3-179
3.3.3	Non-native invasive plant species	3-290
3.4	Social Environment, Direct, Indirect, and Cumulative Effects.....	3-296
3.4.1	Recreation Opportunities and Forest Settings	3-296
3.4.2	Congressionally Designated Areas.....	3-329
3.4.3	Administratively Designated Special Areas	3-360
3.4.4	Scenery Management.....	3-370
3.4.5	Heritage Resources	3-380
3.4.6	Forest Products	3-385
3.4.7	Economics.....	3-399

3.4.8	Social Conditions	3-419
3.5	Resource Commitments	3-444
3.5.1	Unavoidable Adverse Effects and Mitigation	3-444
3.5.2	Relationship Between Short-term Uses and Long-term Productivity	3-445
3.5.3	Irreversible and Irretrievable Commitments of Resources	3-445
3.5.4	Energy Requirements and Conservation Potential.....	3-446
4	LIST OF PREPARERS.....	4-1
4.1	Interdisciplinary Core Team	4-1
4.2	Forest Leadership Team	4-8
4.3	Other Major Contributors.....	4-9
5	ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS	5-1
5.1	Agencies Consulted and Receiving Documents.....	5-1
5.1.1	Federal Agencies	5-1
5.1.2	Native American Tribal Governments	5-1
5.1.3	State Agencies	5-1
5.1.4	Local Officials, Groups, Organizations, and Individuals.....	5-2
5.2	List of Recipients.....	5-3
6	GLOSSARY	6-1
6.1	Abbreviations and Acronyms.....	6-1
6.2	Terms	6-2
7	REFERENCE LIST.....	7-1
8	INDEX.....	8-1

LIST OF TABLES

Table 2-1. Management area allocation by alternative (Acres)	2-46
Table 2.2. Past management activity levels and future projected management activities (annual average/year except where noted) by alternative for decades 1 & 2	2-47
Table 2-3. Evaluation criteria by issue and alternative	2-54
Table 2-4. Estimated number of wells and miles of road by midpoint of second decade	2-60
Table 3-1. ANF mineral ownership and status	3-4
Table 3-2. ANF Federal minerals (stipulations by alternative) acres	3-6
Table 3-3. Relative risk to soil nutrients from potential FS activities by alternative	3-17
Table 3-4. Proposed activities by alternative mapped on soil units with severe or very severe erosion potential ratings	3-17
Table 3-5. Sub-basin, watersheds and acres, and percent FS lands within each	3-23
Table 3-6. Streams on the 303(d) list of water quality limited streams and lakes	3-28
Table 3-7. Fixed-width distances for the delineation of the riparian corridor in Alternatives B, Cm, and D.....	3-30
Table 3-8. Distribution of forest age across ANF lands within the riparian corridor	3-30
Table 3-9. Watersheds and percentage of land suitable for timber management in watersheds within the proclamation boundary.....	3-44
Table 3-10. Proposed road work by 2060 within 300 feet of mapped streams (miles).....	3-46
Table 3-11. Estimated future average annual air pollutant emissions from prescribed burning on the ANF	3-59
Table 3-12. Estimated future average annual air pollutant emissions from timber harvest on the ANF	3-61
Table 3-13. Estimated future average annual air pollutant emissions from all terrain vehicles and off highway motorcycles on the ANF	3-62
Table 3-14. Estimated future average annual air pollutant emissions from prescribed burning, timber harvest, all terrain vehicles and off highway motorcycles on the ANF	3-63
Table 3-15. Total road and trail miles within the ANF proclamation boundary, 2003	3-68
Table 3-16. Projected road system by alternative	3-71
Table 3-17. Cumulative miles of road construction and pit acreage consumed	3-74
Table 3-18. Present ANF forest types	3-85

Table of Contents

Table 3-19. Overstory and understory species composition, summarized for all ANF tree species	3-86
Table 3-20. Present age class distribution by forest type, ANF	3-89
Table 3-21. Present stocking levels of forest vegetation more than 50 years old on the ANF	3-92
Table 3-22. ANF understory vegetation conditions based on surveys at three different scales and points in time	3-92
Table 3-23. Cumulative defoliation on land (private and National Forest system) within the ANF proclamation boundary	3-95
Table 3-24. 1986 forest plan harvest and reforestation activity accomplishments by management area (1986-2005)	3-106
Table 3-25. Forest type outcomes in decades 1 and 2 by LRMP alternative	3-134
Table 3-26. Forest type outcomes in decade 6 by LRMP alternative	3-134
Table 3-27. Age class outcomes in decades 1 and 2 by LRMP alternative	3-137
Table 3-28. Age class outcomes in decade 6 by LRMP alternative	3-139
Table 3-29. Characteristics of areas allocated for multi-aged, late structural, or old growth vegetation in each alternative – decade 2	3-140
Table 3-30. Characteristics of areas allocated for multi-aged, late structural, or old growth vegetation in each alternative – decade 6	3-142
Table 3-31. Estimated average annual amount (Decades 1 and 2) of understory treatments to improve understory and midstory condition	3-147
Table 3-32. Estimated acres (rounded to nearest 100) regenerated by silvicultural system and management area- decades 1 and 2	3-151
Table 3-33. Estimated cumulative acres (thousands of acres) regenerated on the ANF by silvicultural system and management area- decades 1 through 6	3-153
Table 3-34. Estimated cumulative reforestation and regenerated acres (thousands of acres) on the ANF by silvicultural system - decades 1 through 6	3-158
Table 3-35. Estimated acres (rounded to nearest 100) regenerated by silvicultural system and forest type --decades 1 and 2	3-160
Table 3-36. Estimated cumulative acres (thousands of acres) regenerated by silvicultural system and forest type -- decades 1 through 6	3-161
Table 3-37. Forest land ¹ ownership within four county cumulative effects area	3-162
Table 3-38. Vegetation within four county cumulative effects area (percent)	3-167
Table 3-39. Structural size classes within four county cumulative effects area (Percent)	3-170
Table 3-40. Area of forest land by ownership group and stocking class -- Elk, Forest, McKean, and Warren Counties -- 2004 (thousands of acres)	3-171
Table 3-41. Harvest type acres by ownership class for Elk, Forest, McKean, and Warren Counties, 1986-2005	3-177
Table 3-42. Harvest projections decades 1 and 2 by ownership class for Elk, Forest, McKean, and Warren Counties	3-177
Table 3-43. Description of structural stages used in SPECTRUM modeling for the ANF	3-185
Table 3-44. Landscape codes used to describe desired landscape conditions and management activities by management area	3-186
Table 3-45. Core forested areas on National Forest System lands that occur greater than ¼ mile from existing classified roads	3-193
Table 3-46. ANF management indicator species and selection rationale	3-195
Table 3-47. Preferred cerulean warbler nesting habitat	3-200
Table 3-48. Species with viability concern on the Allegheny National Forest	3-206
Table 3-49. Primary indicators and measures of plant and animal effects	3-213
Table 3-50. Current and estimated future (2020 and 2060) structural stage conditions for National Forest System lands by alternative	3-220
Table 3-51. Alternative Landscape Conditions	3-220
Table 3-52. Percent of oak managed by primary silvicultural system under each alternative	3-222
Table 3-53. Estimate of current oak types by structural stage at 2020 and 2060 by alternative	3-222
Table 3-54. Percent of the highest quality remote habitat that will remain relatively free of new Forest Service roads and motorized trails by alternative* (The present condition is the same as Alternative A)	3-228
Table 3-55. Acres managed with an emphasis on habitat connectivity	3-229
Table 3-56. Alternative landscape conditions of active goshawk territories (percent of ANF)	3-232
Table 3-57. Suitable goshawk nest habitat by alternative (percent of ANF)	3-232
Table 3-58. Goshawk territories within alternative IUAs	3-233

Table 3-59. Cerulean warbler alternative habitat changes	3-235
Table 3-60. Road densities of occupied cerulean warbler habitat	3-238
Table 3-61. Cerulean warbler habitat landscape conditions by alternative (% ANF lands)	3-238
Table 3-62. Alternative mourning warbler habitat	3-245
Table 3-63. Estimated intensive use area trail miles and density by alternative	3-250
Table 3-64. Species with viability concerns – outcomes by primary broad habitat by alternative for direct and indirect effects	3-256
Table 3-65. Optimal, suitable and less than suitable habitat for the Indiana bat by alternative	3-258
Table 3-66. Summary of habitat indicators by alternative	3-260
Table 3-67. Miles of new road and motorized (ATV/OHM) trail on Forest Service lands during the planning period by alternative	3-267
Table 3-68. Percent of connected and core habitat within known oil and gas fields	3-267
Table 3-69. Northern goshawk cumulative effect summary	3-270
Table 3-70. Cerulean warbler cumulative effects summary	3-271
Table 3-71. Habitat considerations for timber rattlesnake, by alternative	3-274
Table 3-72. Cumulative effects mourning warbler habitat by alternative in the sixth decade (percent of the analysis area boundary)	3-278
Table 3-73. Species with viability concerns – outcomes by primary broad habitat by alternative for cumulative effects	3-287
Table 3-74. ROS classifications and acreage on the Allegheny National Forest	3-300
Table 3-75. Developed recreation sites and capacity, Allegheny National Forest	3-301
Table 3-76. Occupancy rates, campgrounds on the Allegheny National Forest, 1997-2004	3-302
Table 3-77. Current miles of trail, Allegheny National Forest	3-303
Table 3-78. ANF snowmobile trails/connectors	3-304
Table 3-79. Existing trail by trail type, Allegheny National Forest	3-304
Table 3-80. Estimated site visits in millions at national forests by region, (2000 and 2001)	3-310
Table 3-81. ROS category by alternative	3-315
Table 3-82. Desired ROS class by management area, Alternatives B, Cm, and D	3-315
Table 3-83. Number of areas and acres of management area 7.2 by alternative	3-317
Table 3-84. Miles of road decommissioned to support remote recreation areas by alternative	3-319
Table 3-85. Acres and areas available for ATV/OHM trail development by alternative	3-320
Table 3-86. Allocation of EUAs by alternative	3-323
Table 3-87. EUA overlay and riding restrictions by management area	3-324
Table 3-88. Forest plan revised roadless areas	3-331
Table 3-89. Comparison of wilderness study areas by alternative	3-336
Table 3-90. Management area allocation by alternative for potential WSA	3-336
Table 3-91. Timber production and new road construction by alternative in RARE II areas	3-338
Table 3-92. Projected wilderness visits for the ANF	3-339
Table 3-93. Kinzua Creek nationwide rivers inventory summary	3-345
Table 3-94. Outstandingly remarkable value classifications, Allegheny and Clarion Rivers	3-346
Table 3-95. Management areas allocated in the NRA by alternative	3-356
Table 3-96. Activities allowed in NRA vs. wilderness	3-356
Table 3-97. Crosswalk of VMS and SMS terms	3-371
Table 3-98. Scenic class allocation by acre and SIL	3-371
Table 3-99. Final scenic integrity level assignments	3-374
Table 3-100. Very high SIL acreage by alternative	3-374
Table 3-101. Scenic integrity levels by alternative	3-375
Table 3-102. Potential impacts to scenery by alternative	3-376
Table 3-103. High impact harvesting in areas of scenic concern	3-377
Table 3-104. Actual harvest activity accomplishments (1986 – 2005) compared to “1986 Forest Plan” and “Timber Harvest Program Capability Report” harvest volumes for 1986 – 2005	3-391
Table 3-105. Lands tentatively suited for commercial timber harvest, 1986 and LRMP	3-392
Table 3-106. Suitable land for timber production	3-394
Table 3-107. ASQ and LTSY by alternative	3-395

Table of Contents

Table 3-108. Economic characteristics summary, Elk, Forest, McKean, and Warren Counties and Pennsylvania	3-408
Table 3-109. Current role of Forest Service-related contributions to the area economy	3-412
Table 3-110. Forest Service impacts upon ANF region economy	3-413
Table 3-111. Employment by program by alternative (average annual, first two decades)	3-414
Table 3-112. Employment by major industry by alternative (average annual, first two decades)	3-415
Table 3-113. Labor income by program by alternative (average annual, first two decades)	3-416
Table 3-114. Labor income by major industry by alternative (average annual, first two decades)	3-416
Table 3-115. Forest Service revenues/payments to sounties (average annual, first two decades)	3-417
Table 3-116. Change in population, 1960-2000	3-423
Table 3-117. Population 1950 - 2020 by geographic region within Pennsylvania	3-424
Table 3-118. Population 1990 - 2000 by national, state and ANF counties	3-424
Table 3-119. Age cohorts by Pennsylvania geographic region	3-425
Table 3-120. Projected youth and senior populations by Pennsylvania region	3-426
Table 3-121. Highest level of education by Pennsylvania geographic region	3-427
Table 3-122. School expenditure statistics by Pennsylvania geographic region	3-427
Table 3-123. Migration by Pennsylvania geographic region	3-429
Table 3-124. Households/families by Pennsylvania geographic region	3-430
Table 3-125. Possible rankings of alternatives by active interest groups	3-440

LIST OF FIGURES

Figure 3-1. Watersheds on the Allegheny National Forest	3-24
Figure 3-2. Air quality cumulative effects analysis area	3-56
Figure 3-3. Maintenance Level 1 Road	3-66
Figure 3-4. Maintenance Level 2 Road	3-66
Figure 3-5. Maintenance Level 3 Road	3-67
Figure 3-6. Maintenance Level 4 Road	3-67
Figure 3-7. Maintenance Level 5 Road	3-67
Figure 3-8. Ecoregions of the United States (McNab and Avers 1994)	3-76
Figure 3-9. Subsections 212Ga and 212Gb	3-76
Figure 3-10. ANF seedling age class (0-10) created by year (acres)	3-90
Figure 3-11. Beech bark disease complex progression of advancing and killing fronts on the ANF, 1985-2003	3-99
Figure 3-12. Acres of deer and turkey winter range in each intensive use area by alternative	3-249
Figure 3-13. PA Wilds market area	3-298
Figure 3-14. ATV permit sales, 2002-2005	3-306
Figure 3-15. Predicted future ANF visits	3-311
Figure 3-16. Existing scenic integrity levels, ANF Source: GIS Inventory	3-372
Figure 3-17. Average black cherry price (\$/MBF) and average sawtimber price (\$/MBF) adjusted for inflation, September 2005	3-387
Figure 3-18. 1986 Forest Plan ASQ (1986-2005) and actual accomplishments (1986-2005) based on sales awarded	3-390
Figure 3-19. ANF economic region	3-401
Figure 3-20. Employment by major sector, Pennsylvania	3-403
Figure 3-21. Employment by major sector, ANF Region	3-403
Figure 3-22. Per capita personal income	3-405
Figure 3-23. Payments to local governments	3-406

Summary

Final Environmental Impact Statement



Cover photo: Allegheny River Islands, R Hokans, photographer

This page intentionally left blank.

PURPOSE AND NEED

Introduction

The executive summary provides an overview of the Final Environmental Impact Statement (FEIS) for revision of the 1986 Allegheny National Forest Land and Resource Management Plan (1986 Forest Plan). The FEIS discloses the potential effects of applying four alternatives for revising the 1986 Forest Plan in a comparative format. Included in the analysis are potential physical, biological, and social effects from implementing each alternative. The selected alternative is Alternative C modified (Cm).

The 2006 Land and Resource Management Plan (LRMP) replaces the 1986 Forest Plan. The Forest Plan revision process was conducted in accordance with planning regulations in place prior to November 9, 2000, as allowed under the January 2, 2005 Department of Agriculture final rule for National Forest System Land Management Planning (36 CFR Part 219). The FEIS follows the implementing regulations of the National Environmental Policy Act (NEPA) found in 40 CFR, Part 1500-1508.

Purpose and Need for Change

The Allegheny National Forest (ANF) has revised its 1986 Forest Plan as required by the National Forest Management Act (NFMA) of 1976.

The revised LRMP is designed to meet the legal requirements of the NFMA and to incorporate new scientific knowledge on topics including ecological information, vegetation management, species viability, soils, insects and diseases, known changes in forest conditions, and recreational user trends and preferences. Specifically, the revision addressed three major areas of change: (1) vegetation management,

(2) habitat diversity, and (3) recreation and special area designation.

Vegetation management involves maintaining healthy forest conditions capable of providing sustainable levels of forest products. It includes maintaining a diversity of tree species and age classes, addressing forest health, reforestation techniques, and the silvicultural systems used.

Habitat diversity is primarily concerned with maintaining viability of native and desired non-native species. This includes providing for a diversity of forest structural conditions. Ecosystem and species diversity, and habitat connectivity are emphasized. Game species, threatened and endangered species, and non-native invasive species are considered.

Recreation involves provision of an appropriate array of recreational opportunities for the public. It includes determining actual recreational settings across the ANF and determining the type and amount of opportunities provided. The analysis of the need for change also identified a need for consideration of additional special area designations including the potential wilderness study areas.

Proposed Action

The proposed changes to the Forest Plan include:

- Restructuring the Forest Plan
- Changes to desired conditions, goals, objectives, suitable uses, and standards and guidelines
- Adjustment of management areas
- Recommendations for wilderness study areas and other special designations
- Establishing the allowable sale quantity, or ASQ

The proposed Land and Resource Management Plan (LRMP) is based on Alternative Cm.

Forest Plan Decisions

The ANF chose to narrow the scope for revising the Forest Plan by focusing on issues identified in the Need for Change section above as being most critically in need of change. The LRMP makes the following types of decisions:

- Desired conditions, goals, and objectives that express an aspiration and form the basis for projects, activities, and uses that occur under the Forest Plan
- Suitability determinations, standards, and guidelines that set requirements to limit or guide forest uses or activities that are expected to occur under the Forest Plan
- Management area and special designations, or recommendations for special designations, that identify areas for different desired conditions, uses, standards, and guidelines
- Monitoring and evaluation requirements for Forest Plan implementation

Public Involvement and Collaborative Planning

Citizens, tribes, government agencies, and public and private organizations were contacted by mail, e-mail, and through announcements in broadcast and print media throughout the Forest Plan revision process. This revision began in 1997 when the ANF solicited public comment to identify need for change (NFC) items. In 1998, the process halted due to Agency and Congressional direction, including budget constraints. Forest planning resumed in 2003 and comments received during the initial planning stage were reviewed. The ANF used “collaborative

learning” workshops through the fall of 2003 to discuss and finalize the NFC and the forest planning process.

The Notice of Intent (NOI) was published in the Federal Register on September 23, 2003 and two public meetings were held to discuss the NFC and NOI. Comments (192) were received during the public comment period, which ran from September 25, 2003 through November 10, 2003. In 2004, two facilitated workshops were used to develop draft alternatives. These initial draft alternatives were discussed at facilitated public meetings in 2005.

The proposed LRMP and DEIS were released in May 2006 and the comment period on the proposed Forest Plan and the DEIS ran from May 26, 2006 to August 28, 2006. Following the release, there were eight open house meetings throughout Pennsylvania, meetings with stakeholder groups, and two hearings. More than 8,000 comments were received.

In addition to these public meetings, government-to-government meetings were held with the Commonwealth of Pennsylvania, the Seneca Nation of Indians, county commissioners from Elk, Forest, McKean, and Warren counties, township supervisors, and school district superintendents. A description of the public involvement process is available in Appendix A of the FEIS.

Issues

Forest Plan revision issues are those areas of forest management that require a change as a result of new scientific information, resource changes, a better understanding of previous management based on monitoring and evaluation information, or changing public needs.

The issues identified through the planning and public participation process were categorized into two groups, significant issues and other areas of concern.

This helped define the scope of the analysis documented in the FEIS. Significant issues contain a major dispute that necessitates varied approaches in the alternatives. Significant issues are addressed through Forest Plan decisions. Other areas of concern identified in the Notice of Intent are addressed through improved standards and guidelines or monitoring strategies in the LRMP.

Each issue and relevant components are presented below. Components that were most likely to change across alternative were assigned specific evaluation criteria used to measure each alternative's response to an issue and to help summarize the effects of each alternative. Components that do not change by alternative were discussed briefly to carry forward the discussion started in the Notice of Intent.

Forest Vegetation Management

This issue involves determining the desired mix of vegetative conditions needed for the ANF, the appropriate mix of management, and opportunity to provide forest products. The conditions estimated in the sixth decade were selected as a measure to compare long-term effects by alternative. The seven components discussed below will be used to answer the following questions:

1. What mix of forest types should define the desired vegetation composition?
2. What distribution by age classes should be assigned to the desired vegetation structure?
3. How will forest health be addressed?
4. What will be the acreage of forest land suitable for timber production?

5. What will be the mix of silvicultural systems used?
6. How will reforestation techniques be modified to meet changing conditions and new information?
7. What harvest schedule and mix of forest products should be featured?

Habitat Diversity

This issue involves maintaining the viability of native and desired non-native species found on the ANF. The habitat diversity issue centers on the composition and arrangement of ecological communities present on the landscape. What mix of desired conditions should be featured and what mix of activities and protections will produce the desired outcomes? Five major components for this issue address the following questions:

1. What combination of habitats and habitat elements are necessary to sustain the diversity of native and desired non-native species on the ANF?
2. Where and how much area should be allocated to late structural forests while emphasizing habitat connectivity?
3. What conservation measures are needed to conserve habitat for threatened, endangered, and sensitive species and ensure species viability?
4. What guidelines and treatments are needed to effectively control non-native invasive species?
5. How can habitat for game species be enhanced while providing hunting and fishing opportunities and managing populations in balance with the habitat?

Recreation and Special Areas

This issue involves determining the types and amount of recreation opportunities and special areas which will be provided on the ANF. Six components of this issue address the following questions:

1. To what extent can the ANF provide developed recreation opportunities and how should they be managed?
2. To what extent can dispersed recreation be addressed to improve non-motorized recreation opportunities and clarify direction for managing concentrated dispersed recreation use?
3. How should trails be managed for different uses and in what areas should they be provided?
4. What areas determined potentially suitable for wilderness should be recommended for wilderness study areas?
5. How will Wild and Scenic Rivers be treated?
6. What will be considered for other Special Area Management (Research Natural Areas, Scenic Areas, Historic Areas, and Experimental Forests)?

Other Planning Areas

The IDT also identified a need to clarify and strengthen guidance in the 1986 Forest Plan for seven other planning areas:

1. soil and water quality
2. heritage resources
3. scenery
4. transportation systems
5. monitoring
6. management areas
7. reorganization of the Forest Plan format

Although the ANF does not own 93 percent of its subsurface where private oil and gas development is legally established, the LRMP and FEIS contains direction and discussion of environmental effects for this development.

ALTERNATIVES

Introduction

The alternatives provide a framework for analyzing different ways of meeting the purpose and need of the LRMP and for addressing the issues discussed in Chapter 1 of the FEIS. The alternatives show a range of options for guiding natural resources management activities on the ANF over the next 10 to 15 years. They express different desired conditions primarily through different management area (MA) allocations. While this document identifies a selected alternative, the key purpose of the document is to describe in detail the consequences of implementing any one of the identified alternatives.

The ANF used the three significant issues as the primary basis on which to focus development of four alternatives that are carried forward for detailed analysis in the FEIS. While all four alternatives provide a wide range of multiple uses, goods, and services, each addresses the issues in different ways.

Changes to Alternatives between DEIS and FEIS

Comments received on the DEIS led to a number of changes in alternatives between the DEIS and the FEIS. All alternatives include the following technical changes:

1. There is a net increase in lands tentatively suitable for timber production due to a correction in the acreage withdrawn for roads of 20,140 acres.
2. There is a projected decrease in lands scheduled for timber production due to adjustments in accounting for future OGM development under all four alternatives.
3. Final harvest of overstories for existing shelterwood stands are scheduled in the first decade except in oaks stands that have already received a shelterwood cut.
4. Due to greater conservation measures in the LRMP for various species and wetland management zones, 15 percent of the lands suitable for timber production have deferred timber harvest. This is increased from 10 percent in the DEIS (Alternatives B, Cm, and D).

Because of the changes listed above, model results and timber schedules have changed. In the FEIS, activities and outcomes are displayed by decade rather than by planning period. See Table 2 for revised activity numbers under all alternatives. Additional technical changes made to model assumptions are described in Appendix B of the FEIS.

MA 5.0 (Wilderness) has been subdivided into two MAs, 5.1 for existing wilderness and 5.2 for wilderness study areas under all four alternatives.

Alternative C in the DEIS was modified based on public comments and is presented as Cm in the FEIS. Changes from Alternative C to Alternative Cm include:

1. A net decrease in wilderness study areas (MA 5.2) of 1,717 acres. The Tracey Ridge area (9,033 acres) is now in MA 8.2 (National Recreation Area) and 7,316 acres of the Minister Valley area (east of FR420) is now in MA 5.2.

2. A net decrease of 11,954 acres in Remote Recreation Areas (MA 7.2) based primarily on the reclassification of most of the Minister Valley area as wilderness study area. Decrease of acres also includes reclassification of the remaining 1,829 acres of the Minister Valley area as MA 3.0 and reclassification of the Morrison Area to Landscape Linkages (MA2.2). Morrison Valley is no longer considered suitable for remote recreation area due to recent increases in oil and gas development.
3. A net decrease of 14,196 acres in intensive use areas (IUAs). The proposed Longhouse IUA has been dropped from this alternative.
4. A net decrease of 2,269 acres in Landscape Linkages (MA 2.2) due to:
 - Several locations with oak stands were shifted to MA 3.0
 - Owls Nest Area MA 1.0 was enlarged to reflect current size. It had been reduced in acreage on the east with 1,722 acres having been allocated to MA 2.2
 - Morrison Area changed from MA 7.2 to MA 2.2
 - Several locations were added to the MA 2.2 from MA 3.0 to provide further protection for the timber rattlesnake
5. A net increase of 1,848 acres in Late Structural Habitat (MA 6.1) including several visible hillsides along the Allegheny River previously included in MA 3.0.
6. A net increase of 3,390 acres in MA 3.0 in the western part of Minister Valley and the addition of some oak areas previously classified as MA 2.2.

A number of standards and guidelines in the LRMP have been changed to reflect new knowledge and comments received. In particular, one management

indicator species (MIS) representing early structural habitat has been added (the mourning warbler) and goals and objectives have been added relating to acquisition of subsurface mineral rights. Greater detail is available in the monitoring Forest Plan provided with the LRMP.

Elements Common to all Alternatives

All of the alternatives considered comply with applicable laws and regulations and all were evaluated with the same set of technical assumptions and data. The following elements are common to all alternatives:

- White-tailed deer are managed for densities that range between 10 and 20 deer per square mile
- Trail management for all uses except ATV/OHM and equestrian use
- Forest health treatments for insects and disease
- Management of oil and gas development, although Alternatives B, Cm, and D have new standards and guidelines
- All areas with special designations under the 1986 Forest Plan continue to be protected

Alternatives Considered in Detail

Alternative A: Continuation of the 1986 Forest Plan

Alternative A is a continuation of the management direction contained in the 1986 Forest Plan. It is the “no-action” alternative for the FEIS. While this alternative continues the management direction of the 1986 Forest Plan, the evaluation of activities, outputs, and environmental effects uses the same technical assumptions of all the other alternatives. In this way, Alternative A serves as a baseline for

evaluating the effects of continuing the current management of the ANF.

Alternative A emphasizes retention and regeneration of Allegheny hardwood and oak forest types, which is accomplished primarily through even-aged management. Older forests are provided in disconnected patches across the ANF (primarily in MA 6.1). Herbicide buffers in Alternative A would follow current Forest Plan direction. Alternative A provides the greatest amount of early structural habitat. Although patches of older forest are provided, they are not connected across the landscape. Approximately 92 percent of the ANF would be in management areas that feature even-aged harvest methods. The remaining management areas would have no active management.

Alternative A includes:

- Five intensive use areas (IUAs) for ATV/OHM use on designated trails
- Open riding across the ANF for equestrians
- Few areas for semi-primitive, non-motorized recreation
- Current Forest Plan direction for protection of riparian areas and threatened, endangered, and sensitive species

Alternatives B, Cm, and D: Modification of the 1986 Forest Plan

Alternatives B, Cm, and D provide a range of opportunities for vegetation, recreation, and habitat management. The three alternatives have a number of features in common:

- Updated standards and guidelines for herbicide application
- Updated standards and guidelines for habitat protection for threatened and endangered species and species with viability concerns

- Objectives, standards, and guidelines for greater protection of riparian corridors and wetland zones
- Adjustment of MA 7.1 to provide developed recreation with considerable facilities
- Provision of MA 8.1 for management of recreation and scenic river segments on Wild and Scenic Rivers
- Recommendation for expansion of the Kane Experimental Forest
- Recommendation of Buckaloons as a designated historic area
- All previously identified RARE II areas do not allow scheduled timber production and new Forest Service road construction
- Modified direction related to oil and gas development including goals, objectives, standards, and guidelines to better balance subsurface development with conservation of surface resources

Alternatives B, Cm, and D all include intensive use areas (IUAs) in which ATV/OHM trail development and use is allowed only on designated trails. In addition to the modifications identified above, Alternatives B, Cm, and D vary as follows:

Alternative B

Alternative B emphasizes increasing the amount of younger forest habitat primarily through regeneration timber harvest of Allegheny hardwood stands. In addition to the features previously described, Alternative B modifies Alternative A by adding MA 2.2 to provide large patches of older forest in a connected pattern across the landscape. Approximately 73 percent of the ANF would be in MAs that feature even-aged harvest methods. Five percent would be in MAs featuring uneven-aged methods, and 22 percent in MAs with no active vegetative management.

Alternative B includes:

- The greatest level of early structural habitat conditions
- One area (Clarion River) managed for remote recreation
- One area (Minister Valley) managed for interpretive recreation
- No recommendations for additional wilderness study areas
- Five IUAs for ATV/OHM use on designated trails
- Four EUAs where equestrian use is limited to designated trails but open riding is permitted on most of the rest of the forest

Alternative C (modified)

Alternative Cm emphasizes a balanced mix of forest age classes and habitat diversity. MA 2.2 is both larger and more connected in this alternative than Alternative B to provide a more contiguous forest canopy and increased resiliency to natural disturbance events. Greater retention of late structural conditions in MAs 3.0 and 6.1, and in wilderness and remote recreation areas also provides older forest habitat. Approximately 67 percent of the ANF would be in MAs that feature even-aged harvest methods. Seven percent would be in MAs featuring uneven-aged methods, and 26 percent in MAs with no active vegetative management.

Alternative Cm includes:

- Recommendation for two wilderness study areas (Minister Valley (east of FR420) and Chestnut Ridge), totaling more than 12,000 acres
- Three remote recreation areas (Clarion River, East Fork Hickory Creek, and Hearts Content), totaling approximately 9,074 acres

- Four IUAs for ATV/OHM use on designated trails (total acreage in IUAs is less in Alternative Cm than in Alternative B)
- Four EUAs where equestrian use is limited to designated trails, but open riding is permitted on most of the rest of the forest

Alternative D

Alternative D emphasizes restoration of older forest conditions in upland and northern hardwood forest types. This alternative provides the largest acreage of land area in MA 2.2 to provide a more contiguous forest canopy and increased resiliency to natural disturbance events. This alternative provides the greatest acreage of land managed with uneven-aged silviculture in the long term.

Greater retention of older forests in MAs 3.0 and 6.1 and in wilderness and remote recreation areas also provides for late structural habitat. Early structural habitat has less emphasis and is provided in MAs 1.0 and 3.0. Approximately 37 percent of the ANF would be in MAs that feature even-aged harvest methods. Thirty-two percent would be in MAs featuring uneven-aged methods, and 31 percent in management areas with no active vegetative management.

Alternative D includes:

- The greatest acreage in intermediate and older forest conditions
- Recommendation for four wilderness study areas (Tracy Ridge, Chestnut Ridge, Minister Valley and Allegheny Front), totaling nearly 30,000 acres
- Six remote recreation areas (Clarion River, Lamentation Run, Hearts Content, Morrison, Longhouse, and South Cornplanter) totaling 30,948 acres of remote recreation areas

- Three IUAs for ATV/OHM use on designated trails with the least acreage in IUAs than any other alternative
- Three EUAs where equestrian use is limited to designated trails

Alternatives Considered but Eliminated

The ANF received a variety of proposals for consideration during development of alternatives. These proposals included both full alternatives and specific design elements and came from citizen and local government groups and individuals. Many of the elements presented were considered during the planning process. For example, areas recommended for wilderness were considered through the roadless area inventory and possible wilderness study areas were identified and evaluated. Briefly, the following proposals were considered but eliminated from further analysis as complete alternatives:

Allegheny Wild! By the Allegheny Defense Project. The Allegheny Defense Project (ADP) submitted 84 resolutions relating (broadly) to resource extraction, wilderness and special area management, biological diversity and ecological health, recreation, and the forest planning and appeals process. Essentially, ADP would like to see commercial logging and oil and gas development ended on the ANF and management redirected to restore the forest to “natural” (i.e., pre-settlement) conditions. Many of the issues raised in the ADP report are addressed in the LRMP either through revised standards and guidelines or consideration of the range of alternatives. Some of the issues raised (e.g. ending commercial timber harvesting) did not address the purpose and need of the revision, were considered to be outside the scope of the Forest Plan, or were infeasible.

A Citizen’s Wilderness Proposal for Pennsylvania’s Allegheny National Forest by Friends of Allegheny Wilderness. Friends of Allegheny Wilderness (FAW) recommended creating eight new wilderness areas, totaling roughly 54,460 acres, and expanding other special area designations. Areas recommended were considered through the roadless area inventory and wilderness evaluation required for Forest Plan revision. However, not all of the areas recommended by FAW met the criteria for wilderness. Even though all of these areas were not analyzed in detail for wilderness study areas, they are considered in detail for other management areas (primarily remote recreation areas MA 7.2) that retain these areas in a natural condition without roads or scheduled timber harvest.

Recreation and the Need to Increase Motorized Recreational Opportunities on the Allegheny National Forest by Allegheny Trail Riders. The Allegheny Trail Riders recommend planning for and building the entire 503 miles of trail and requisite support facilities that the 1986 Forest Plan EIS said the ANF could support and provided a variety of suggestions to enhance ATV/OHM opportunities on the ANF. Large expansion of the existing ATV/OHM trail system to 503 miles is not considered feasible as it would create too many problems in addressing the habitat diversity part of the purpose and need. It would also be impractical and unsafe to expand ATV/OHM use on open public roads. However, the FEIS does consider a range of IUA development specifically for ATV/OHM and motorized trail bike trail designation.

Multiple-Use and Sustained Yield by Allegheny Alive. This proposal provides recommendations for recreation, timber management, and oil and gas development. The alternatives considered provide a reasonable range of trail development for ATV/OHM and snowmobile use, developed

recreation opportunities, and harvest methods and allowable sale quantity (ASQ). A number of the recommendations made in this proposal are project-level decisions (e.g. site selection for resorts, cabins, and trails) and are therefore outside the scope of the Forest Plan.

Comments on Vegetation Management for the Allegheny National Forest Plan Revision by Allegheny Hardwood Utilization Group. The Allegheny Hardwood Utilization Group (AHUG) made specific recommendations to change existing vegetation management language in the 1986 Forest Plan. Recommended changes to standards and guidelines were considered during development of the LRMP. However, some of the recommendations are not feasible under current conditions (e.g. maintaining approximately 474,000 acres in lands suitable for timber production).

The Nature Conservancy (TNC). The Nature Conservancy's comments centered on improving landscape connectivity and reserve design, limiting oil and gas development, reducing impacts of white-tailed deer, and promoting or restoring native species composition, forest structure, and a mix of successional stages that reflects what would occur under a natural disturbance regime. Revised standards and guidelines, as well as revised management area designations, address many of TNC's concerns. Ending legal development of private oil and gas rights is outside the legal authority of the ANF. The LRMP does contain objectives for acquisition of subsurface rights, especially where acquisition can contribute to recreation and special area issues in the purpose and need.

Local Government Resolutions. A number of local governments passed and sent individual resolutions to the ANF regarding 12 points they support for the future planning of the ANF. Among these points were:

1. 435,000 acres as suitable landbase for timber, with a minimum level of timber harvest of 80 MBF
2. Opening all oak areas for forest management
3. Maintaining 20 percent of the ANF in early successional habitat at any one time
4. Increased opportunities for recreation, including 120,000 acres dedicated for intensive recreation use, accommodation for equine users, planning and site selection for inclusion of modern lodging facilities on or adjacent to the ANF, and a shoreline management strategy regarding the optimum utilization of the Kinzua Reservoir and all contiguous areas
5. Opposition to creation of additional wilderness and landscape corridors

A specific alternative was not crafted in response to these resolutions as some of the alternatives (notably A and B) are responsive to several of the points recommended, other points are not feasible (e.g. maintaining a suitable timber land base of 435,000 acres), and some are outside of the scope of the Forest Plan revision.

Selected Alternative

The selected alternative to revise the 1986 Forest Plan is Alternative Cm. Alternative Cm is designed to maintain the current mix and quality of forest types on the ANF. It allocates harvest activities in all forest types, using approximately 67 percent even-aged management and 7 percent uneven-aged management, with the remaining 26 percent having no active vegetation management. The annual allowable sale quantity in Alternative Cm is 54 MMBF.

In the long run, Alternative Cm would provide 10 percent of the forest in a young age structure, and 28

percent in late structural or multi-aged forest, which would improve habitat diversity across the forest. Remote wildlife habitat would be enhanced under this alternative and most oak forest types would be actively managed to improve species habitat.

Alternative Cm would provide increased opportunities for both semi-primitive remote types of recreation and ATV/OHM trail riding areas. It also provides opportunities for both managed equestrian trails and open riding. The alternative recommends two wilderness study areas.

Comparison of Alternatives

Management area allocation is the primary tool used to achieve differing desired conditions across the Forest. Table 1 compares management area allocations by alternative. This table identifies the acreage allocated to each management area. Management areas are presented as numbers with a decimal (e.g. MA 2.1). Management areas shown in the table with an asterisk in parentheses (*) followed by a different number had a different management area identifier in the 1986 Forest Plan. This table also shows overlay acres for IUAs and EUAs that are allocated on the same land area as management areas.

Table 2 compares the estimated level of management activities and outputs expected in the first and second decades. These estimates are generally described as annual average amounts of the activity that could occur.

The two tables are followed by a brief discussion of each resource analyzed and a summary of environmental consequences.

Oil and Gas Development

Approximately 93 percent of the ANF subsurface is owned by private parties. Today there are an estimated 8,000 wells in production and 1,250 miles of oil and gas roads. Recent development outside of historic known oil fields has occurred in the Hastings and Salmon Creek areas.

Of the remaining 7 percent of the ANF's subsurface rights, four areas totaling 870 acres are leased. As of 2006, none of those leases were producing oil and gas. The LRMP contains direction regarding federal leasing.

Surface disturbance with new well development includes approximately 0.3 acres for each well pad and an additional 0.25 miles of new OGM roads per well. Due to the nature of the oil/gas bearing sands drilled, wells can remain in production for 25 to 30 years.

The ANF has identified an average future projection of 512 new wells per year during the 10- to 15-year Forest Plan period. This would result in an estimated total of 15,680 wells and 3,122 miles of private oil and gas roads in 2020 on ANF lands. This would represent almost a doubling of the ANF surface area developed for oil and gas.

Table 1. Management Area Allocation by Alternative (Acres)

MA #	Emphasis	Alternative			
		A	B	Cm	D
MA 1.0	Early Structural Habitat	7,955	7,575	7,937	6,215
MA 2.1 (*2.0)	Uneven-aged Management	3,617	0	2,837	125,746
MA 2.2	Late Structural Linkages	0	99,482	121,176	128,781
MA 3.0	Even-aged Management	307,770	330,190	287,380	122,831
MA 5.1 (*5.0)	Designated Wilderness	8,979	8,979	8,979	8,979
MA 5.2	Wilderness Study Area	0	0	12,379	29,981
MA 6.1	Late Structural Habitat	126,904	11,922	16,421	28,377
MA 6.2	10/30 Even-aged Management	21,297	0	0	0
MA 6.3	Buzzard Swamp Wildlife Management Area	1,167	1,122	1,122	1,122
MA 7.1 (*7.0)	Developed Recreation Area	1,040	1,772	1,772	1,477
MA 7.2	Remote Recreation Area	0	4,668	9,074	30,948
MA 7.3	Interpretive Recreation Area	0	3,367	0	0
MA 8.1	Wild and Scenic River Corridor (NF land)	0	9,250	9,250	9,215
MA 8.2 (*6.4)	National Recreation Area	20,502	20,152	20,152	4,807
MA 8.3 (*8.0)	Scenic Area	2,115	2,115	2,115	2,115
MA 8.4 (*8.0)	Historic Area	306	306	306	306
MA 8.5 (*8.0)	Research Natural Area	2,111	2,111	2,111	2,111
MA 8.6 (*8.0)	Kane Experimental Forest	1,737	3,463	3,463	3,463
MA 9.1	Managed with Minimal Investment	974	0	0	0
Total Acres (ANF lands)		506,474	506,474	506,474	506,474
Overlay Acres					
Intensive Use Areas	ATV/OHM Use	98,974	113,019	83,202	40,519
Equestrian Use Areas	Equestrian Use	0	10,585	10,585	49,934

Table 2. Past Management Activity Levels and Future Projected Management Activities (Annual Average/Year) by Alternative

Management Activity	Past Level (1986-2005)	Alternative A		Alternative B		Alternative Cm		Alternative D	
		1	2	1	2	1	2	1	2
Overstory Vegetation Mgt. (Acres)									
Intermediate Thinning Harvests	2,594	1,363	1,149	1,035	654	1,000	1,000	195	317
Shelterwood Seed Cut Harvests	969	2,070	2,206	1,950	2,114	1,835	1,715	50	56
Regeneration Harvests (Shelterwood Removal Cut and/or Clearcut with reserves)	1,424	2,423	2,043	2,341	1,917	1,754	1,673	699	812
Uneven-aged Harvests+	327	6	0	403	326	666	320	300	300
Riparian Areas (Acres)									
Riparian Enhancements ++	NE	(103)	(107)	(97)	(99)	(96)	(92)	(61)	(64)
Road Management (Miles)									
Road Construction/ Existing Corridor	NE	13	13	14	14	13	13	11	11
Road Construction New Corridor	9*	8	8	7	7	5	5	5	5
Road Decommissioning	2	2	2	2	2	2	2	3	3
Forest Road System (total by end of decade)	1,269 (Existing)	1,459	1,649	1,459	1,649	1,429	1,589	1,399	1,529
Reforestation Treatments (Acres)									
Herbicide	987	1,805	1,544	2,277	1,898	2,583	1,846	956	1,131
Non-Native Invasive Species Control	30***	500	500	500	500	500	500	500	500
Fencing	735	1,054	1,138	1,285	1,331	1,701	1,429	501	791
Fertilization	766	364	384	343	388	215	228	98	87
Prescribed Burning	72	280	280	650	659	654	649	358	358
Release for species diversity	531	1,562	1,837	1,630	1,997	1,727	2,271	774	1,042
Site preparation	1,385	1,477	1,575	1,686	1,746	1,992	1,658	631	865
Mechanical Hazard Fuel Treatments	3	100	100	350	350	350	350	200	200
Wildlife and Fish Management									
Wildlife Enhancements	2,100	2,100	2,100	1,600	1,600	1,600	1,600	1,200	1,200
Fish Habitat Structures	41	0	0	32	32	32	32	32	32
Recreation									
Motorized Trail System	474	524	574	554	634	514	554	494	514
Construction/reconstruction of developed facilities	71 (Existing)	2	1	2	1	2	1	2	1
Wilderness Areas managed to standard	0	2	2	2	2	4	4	6	6
Economics									
Budget (Thousands, 2005 dollars)	\$16,814	\$27,854	\$28,298	\$28,301	\$28,702	\$26,358	\$25,778	\$17,936	\$18,985
Revenue (Thousands, 2005 dollars)	\$18,070	\$69,066	\$70,840	\$64,554	\$67,502	\$53,411	\$51,303	\$27,176	\$24,354

+ Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

++ Acres of riparian treatments are included in the activities listed above them

+++ ATV/OHM/Snowmobile

++++ Hike/Bike/Horse

* Represents total road construction (past levels were not tracked by new or existing corridor)

** Average number is low due to change from past definition of reconstruction. Numbers going forward include heavy maintenance activity.

*** Treatment only applied past 5 years.

**** Treatment only applied on ANF for the past 10 years

***** Average from 2001-2005

NE = Not Estimated



Photo courtesy of US Forest Service

ENVIRONMENTAL CONSEQUENCES

Introduction

This section provides a brief summary of the major environmental consequences of the alternatives. It begins with a discussion of the major consequences on the major issues (vegetation management, habitat diversity, recreation, and special areas) of the activities estimated under the different alternatives. It then continues with brief discussions of transportation, soils, water, air, scenery, and economics.

Vegetation Management

This discussion on vegetation management compares the alternatives in terms of their influence on forest composition, forest age, forest health risks, and the resulting forest products.

Forest Composition

The discussion of forest vegetation on the ANF begins with a discussion of the major forest types. Four major hardwood types (shown here with their predominant tree species) dominate the ANF:

- Upland hardwoods (red maple, black birch, American beech, and black cherry)
- Allegheny hardwoods (black cherry, white ash, and yellow poplar)
- Oaks (northern red, white, chestnut, black and scarlet oaks)
- Northern hardwoods (sugar maple, American beech, yellow birch, Eastern hemlock)

In addition, several minor forest types (such as hemlock, conifer, and aspen) together comprise less than 5 percent of the ANF land.

Forest type transitions do not occur rapidly except in the case of a major ecological disturbance. Management of the ANF in the short term is not expected to change the mix of forest types substantially in the first two decades under any alternative. Figure 1 displays the changes estimated from the current condition by the sixth decade for each of the alternatives. By the sixth decade, continued management under the different alternatives is expected to have these effects on forest vegetation:

- Upland hardwoods are already the most abundant type on the ANF and are expected to increase in all alternatives. This is primarily because northern and Allegheny hardwoods and oak forest types all have a tendency to transition to upland hardwoods under different circumstances.

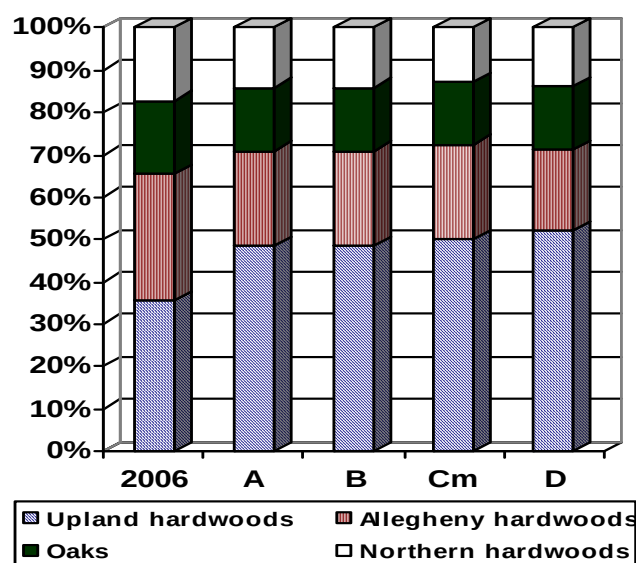


Figure 1. Forest types, current and estimated, 2060

- Allegheny Hardwoods are expected to slightly decline as this forest type ages and as more areas of the ANF are managed with uneven-aged methods or not actively managed.
- Oaks are expected to decline in all alternatives due to the difficulty of developing oak seedling regeneration and limitations on even-aged management in reserved areas.
- Northern hardwoods are expected to also decline in all alternatives primarily as a result of beech bark disease and sugar maple decline.

Forest Age

Currently, 83 percent of forest stands on the ANF are between 51 and 110 years old. Most of the remaining 18 percent is less than 50 years old and nearly 4 percent is older than 111 years of age. An important objective for the Forest Plan is to change this age distribution over a long period. The alternatives manage vegetation differently to emphasize how to create the future forest.

Alternative A heavily emphasizes even-aged management to create a mix of different age classes. Alternatives B and Cm also emphasize even-aged management but also retain larger areas of uneven-aged management to provide for older continuous forest conditions and increased areas with no active vegetation management. Alternative D emphasizes uneven-aged management and allocates more areas to no active management.

Barring large disturbances, the major change in vegetative age classes will be the growth, aging, and mortality of the large group of stands in the 51 to 110 year age range. While only limited change to the age class composition is expected in the first and second decade, by the sixth decade all alternatives would have greater amounts of older forest in the 111 to 140 year and over 141 years age classes. Alternatives A,

B, and Cm would also have larger shares of the forest in the 0 to 20 and 21 to 50 year age classes.

With an emphasis on uneven-aged management, Alternatives B, Cm, and D would also create a multi-aged component. Nearly 12 percent of forest lands would be multi-aged by the sixth decade under Alternative D. Figure 2 displays the current age structure and the changes expected as a result of continuing the Forest Plan by 2060.

Forest Health

Forest health is a complex situation on the ANF. Today's ANF is substantially different than the forest that was dominated by northern hardwoods prior to its nearly complete removal in the early 1900s. As the earlier section on forest composition describes, today's ANF consists primarily of upland and Allegheny hardwood types that have largely replaced the northern hardwood forests. These forests are variants of the broader northern hardwood type and consist of the same species but with different species dominating each type. Most notably, black cherry is more abundant in today's forest, is less tolerant of shade than most other hardwoods on the Allegheny

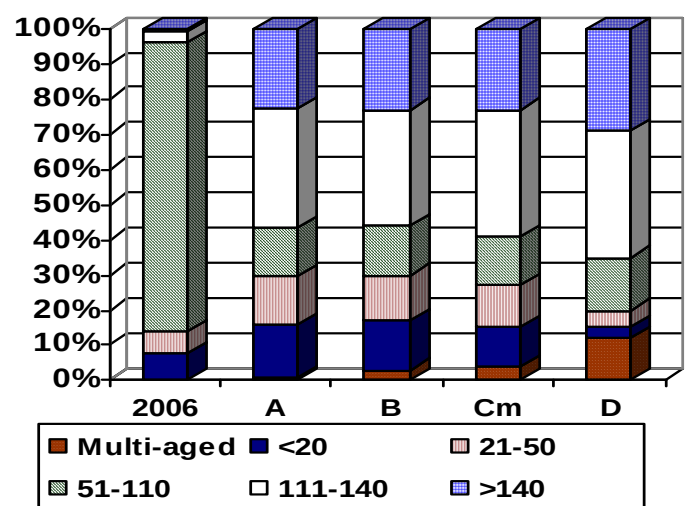


Figure 2. Age Class Outcomes by the Sixth Decade

Plateau, and is shorter-lived than the beeches, sugar maple, and hemlock that once dominated the region's forests.

Deer browsing has had a substantial impact on forest health over the past 70 years. High numbers of deer have selectively grazed the forest understory, heavily impacting some species and allowing others to dominate the forest understory. The result has been diminished diversity in the ANF and substantial difficulty in achieving tree regeneration. To address this problem the ANF has engaged in intensive silvicultural practices including fencing to allow tree seedlings to develop without deer browsing and application of herbicides to remove invasive understory vegetation that interferes with development of tree seedlings. Finally, the ANF has worked with the Commonwealth of Pennsylvania with the DMAP program to bring the deer herd to a density between 10 to 20 deer per-square-mile.

A number of cumulative impacts, primarily from non-native diseases or insects, pose some of the greatest threats to the forest health of the ANF. Currently the beech bark disease complex is already causing substantial death of mature American beech trees on the ANF (66% of all beech trees >6" in diameter in some areas). Hemlock woolly adelgid is an insect that has led to widespread mortality throughout the Eastern United States and has now been located within Elk County. Sugar maple has also been in decline due to site-nutrient limitations in conjunction with other stressors such as drought and defoliation.

The susceptibility of the ANF under the different alternatives to these forest health threats is evaluated to the extent that the alternatives would maintain and perpetuate forest conditions that are likely to be affected. Of the nearly 80 thousand acres of northern hardwoods that currently exist, between 54,200 and 56,600 acres of northern hardwoods are estimated to persist in all alternatives by the sixth decade. As

northern hardwoods are dominated by beech, hemlock, and sugar maple, these acres would be particularly susceptible to beech bark disease, hemlock woolly adelgid and sugar maple decline.

Alternatives that plan to retain older Allegheny hardwood stands (greater than 120 years old) run a greater risk of mortality as the black cherry trees in those stands are more likely to die. At present, there is estimated to be less than a thousand acres of Allegheny hardwoods over 120 years of age, but all of the alternatives will lead to an increased aging of this forest type. By 2060, Alternative B would limit this to nearly 17 thousand acres, but Alternative D would retain 44 thousand acres of older Allegheny hardwoods in this age group. Alternatives A and Cm would retain nearly 25 thousand and 24 thousand acres respectively.

Finally, thinning is often considered to be an effective way to increase tree vigor and overall forest health. By opening the canopy to allow greater sunlight and removing trees in dense stagnant clusters, thinning can improve both the health and vigor of existing trees. Alternative A would schedule the most thinning in the Forest Plan period with Alternative D scheduling the least.

Land Suitable for Timber Production

As part of the Forest Plan revision process, the ANF reviewed its lands that are suitable for timber production. As a result of this review, the ANF concluded that the land that is suitable for timber production must be reduced for this revised Forest Plan. The determination of lands suitable for timber production came in two steps.

The first step is to determine the lands that are tentatively suitable for timber production, or have technical capability, and are available for such use. Table 3 shows a comparison of this first step for the 1986 Forest Plan with the new Forest Plan. The table

shows the total Forest Service lands and then identifies the lands being removed from the suitable base. The major differences between the revised acres and the original 1986 Forest Plan are in three areas:

1. With geographic information systems the ANF is better able to calculate the acreage of the ANF that is not forested. The current mapping revealed a substantially larger amount of roads, including both Forest Service roads and oil and gas roads. (Line 3).
2. The National Recreation Area was not considered withdrawn from timber production to determine tentatively suitable forest lands in the 1986 Forest Plan; in the revision it is withdrawn. (Line 4).
3. Based on experience and improved mapping techniques, the ANF has identified additional lands that are physically unsuitable due to an inability to restock the lands in 5 years. (Line 5).

Table 3. Lands tentatively suitable for timber production

Category	1986 acres	Revised Acres
National Forest System Lands	510,530	516,843
Water	(8,305)	(11,169)
Non-forest land	(22,561)	(42,191)
Forest land withdrawn from production	(15,621)	(34,536)
Forest land Physically unsuitable because restocking is not assured in 5 years	(450)	(20,520)
Forest land Physically unsuitable due to irreversible damage that could occur from timber operations	(450)	(0)
Total unsuitable land	47,387	108,416
Tentatively suitable forest land	463,143	408,427

The second step is to determine of the tentatively suitable lands, which lands are not appropriate for scheduled timber production. This step varied by alternative primarily as different management areas further reduced the amount of land that would be appropriate for timber production, given

various resource objectives. This revised Forest Plan proposes to further remove land from the suitable timber base where scheduled timber harvest is not a desired component of the management area. Table 4 displays this determination for each alternative.

Table 4. Suitable Land for Timber Production (acres)

Category		Acres			
Tentatively Suitable Forest Land		408,427			
Forest Land Not Appropriate for Timber Production by Alternative		Alt. A	Alt. B	Alt. Cm	Alt. D
Forest Land Not Appropriate for Timber Production	MA 5.2 Proposed Wilderness Study Areas	0	0	11,577	13,641
	MA 6.3 Buzzard Swamp Wildlife Management Area	479	479	479	479
	MA 7.1 Developed Recreation Areas	300	280	280	31
	MA 7.2 Remote Recreation Areas	0	4,310	8,417	27,493
	MA 7.3 Interpretive Recreation Area	0	3,077	0	0
	MA 8.1 Wild & Scenic River Corridor	0	5,662	5,662	5,640
	MA 8.4 Historic Area	172	172	172	172
	MA 8.6 Kane Experimental Forest Expansion	0	1,530	1,530	1,530
	MA 9.1 Managed with Minimal Investment	871	0	0	0
	Corridor along Wilderness, Remote, and Class A Wild Trout Streams	0	1,255	1,255	1,255
Total Forest Land Not Appropriate for Timber Production		1,822	16,765	29,372	50,241
Unsuited Forest Land		110,238	125,181	137,788	158,657
Total Suitable Forest Land (MA 1.0, 2.1, 2.2, 3.0, and 6.1)		406,605	391,662	379,055	358,186

Allowable Sale Quantity

The allowable sale quantity (or ASQ) is the maximum amount of timber that can be sold in each decade from the lands that are suitable for timber production. It represents the capability of the ANF under a particular set of management direction to produce timber on a sustainable basis. The ASQ is normally expressed as an average annual amount.

The 1986 Forest Plan for the ANF identified an ASQ of 94.5 million board feet (MMBF) per year (1986 Forest Plan). Following the 1986 Forest Plan a number of concerns emerged over the ANF's ability to produce timber volume in a sustainable way at this level.

This culminated in the 1995 Harvest Capability Report (1986 HCR) that estimated that a harvest level of 53.2 MMBF could be produced over the 1995 through 2005 period. In actual production, the ANF has offered an average of 46.4 MMBF per year from 1986 to 2005 and 20.7 MMBF per year from 2001 to 2005.

Figure 3 shows the four bases for comparison of the ASQ to the four alternatives contained in the DEIS. The numbers for the alternatives show the ASQ for the first decade of the Forest Plan. For all alternatives the ASQ volume is the same for the first and second decades.

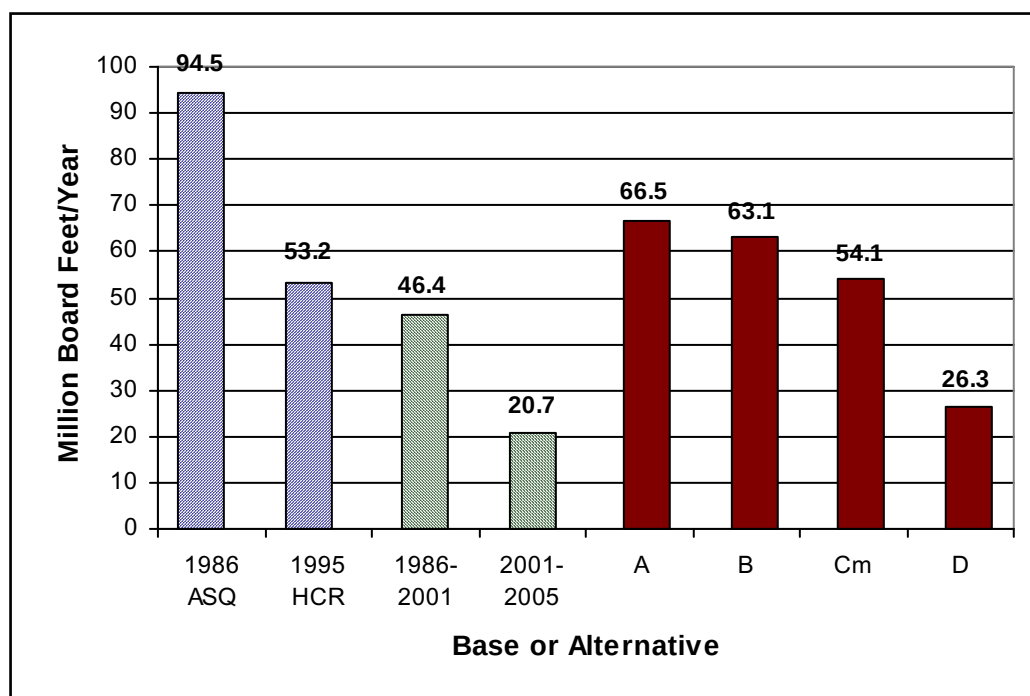


Figure 3. Allowable Sale Quantity

Habitat Diversity

The major effects on habitat diversity are summarized here:

- Changes in forest structural habitat diversity
- Habitat patterns across the landscape
- Trends in habitat for Management Indicator Species (northern goshawk, cerulean warbler, timber rattlesnake, mourning warbler, and aquatic invertebrates)
- Trends in habitat for game species and other species of public interest
- Trends in populations and habitat for species with viability concerns including federally-listed species

Structural Habitat Diversity

Structural habitat diversity is described by the size of trees, the amount of cover provided by the canopy, the mix of dead trees or snags, and the amount of downed vegetation. In a forested setting, structural habitat diversity is closely tied to stand age. Providing an appropriate mix of structural habitats is a key objective in the management of the ANF.

The FEIS and LRMP aggregate structural forest habitat into three major groups. Each of these large structural habitat groups has a number of representative wildlife species that commonly use structural habitat of this type.

Early structural habitat, where the dominant layer of trees is less than 5 inches in diameter, sustains species such as ruffed grouse, Eastern milk snake, and Eastern cottontail.

Mid structural habitat, where the dominant layer of trees is between 5 and 20 inches in diameter, sustains species such as red shouldered hawk, snowshoe hare, and scarlet tanager.

Late structural habitat, where the dominant layer of trees is greater than 20 inches, sustains species such as bald eagle, Northern flying squirrel, and blackburnian warbler.

Currently, 77 percent of the ANF is in a mid structural condition, 7 percent is in an early structural condition, and 4 percent is in a late-structural condition. The remaining land base is in a non-forest condition. Major shifts in structural conditions will not occur within the first two decades. However, if the Forest Plan were continued through the sixth decade long-term effects on structural habitat diversity would be evident, and each of the alternatives considered would provide a different mix of structural conditions (Figure 4).

By 2060, all of the alternatives will feature a substantial increase of late structural habitat. Alternative D emphasizes this type of habitat; nearly 39 percent of the ANF would be in this condition. Alternative A would provide the least amount of late structural habitat, at 24 percent. Early structural habitat is emphasized in Alternatives A, B, and to a lesser extent, Cm. Alternative D would maintain early structural habitat at the lowest level.

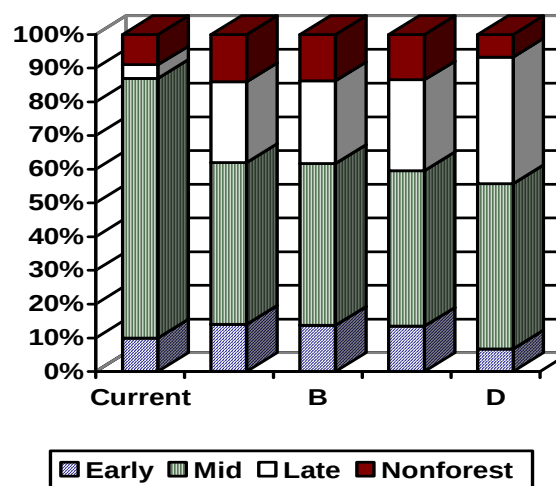


Figure 4. Percent of forest land by structural habitat diversity by alternative, 2060

Landscape Patterns

Remote Habitats

Of the 37 unroaded areas greater than 500 acres identified in the Forestwide Roads Analysis (USDA FS 2003), 29 areas are considered quality remote wildlife habitat and 8 areas are considered high quality remote wildlife habitat. The percent of the 29 quality remote habitats (28,200 acres) and 8 high quality remote habitats (33,000 acres) that will remain in management areas where FS roads and motorized trails are prohibited or greatly restricted is shown by alternative in Table 5.

Note that although ANF management would retain these remote characteristics, road construction for private mineral development could occur in these areas. One high quality area (Morrison) has lost its remote character due to oil and gas development, and thus it is not possible to retain all of these areas.

Core Areas and Habitat Connectivity

Under the 1986 Forest Plan (Alternative A), landscape connectivity of late structural forests is not explicitly provided, although late structural habitat is provided for in MA 6.1, MA 6.2, and existing special designations. The design of Alternatives B, Cm, and D provides for a connected approach of late structural habitat across the ANF landscape. This consists of core areas that are managed to develop late structural habitat, usually without active vegetation management and landscape linkages (MA 2.2) that are managed with active silviculture to provide for late structural habitat and remote habitat across the ANF landscape.

The acreage that would be managed with an emphasis on connectivity and an emphasis on core areas is provided in Table 6. This table displays the acreage provided in each type and the percent of the ANF based on management area land allocations.

None of these areas would allow new Forest Service road construction; therefore they would provide a relatively unroaded opportunity to maintain species associated with late structural forests across the ANF. Note that although ANF management would retain these characteristics, road construction for private mineral development could occur in these areas.

Table 5. Percent of Remote Habitats Retained

	Alternative			
	A	B	Cm	D
Percent of High Quality Remote Habitat Retained (8 areas, 33,000 acres)	63%	81%	88%	88%
Percent of quality remote habitat (29 areas, 28,200 acres)	35%	38%	60%	60%

Table 6. Acreage managed with an emphasis on core areas and connectivity

Emphasis	Alternative			
	Alt A	Alt B	Alt Cm	Alt D
Core Areas (MA 5.0, 7.2, 7.3, 8.2, 8.3, 8.5,)	34,000 7%	41,000 8%	55,000 11%	79,000 15%
Landscape Linkages (MA 2.2)	0 0%	99,000 19%	121,000 23%	129,000 25%

Management Indicator Species

Management indicator species (MIS) are used to gauge the effects of the alternatives on wildlife habitat. MIS are expected to reflect the effects of the alternatives on ecological communities of management interest. In revising the MIS list, emphasis has been placed on species that are closely associated with habitats of interest and species that can produce meaningful data about the effects of forest management activities on a few major communities of interest.

Northern Goshawk

While all alternatives maintain viable goshawk populations and provide adequate habitat to support desired nesting densities, they each vary in terms of the quality and quantity of habitat that will be provided at the landscape scale. Table 7 displays the percent of the ANF with suitable goshawk nesting habitat that would be expected to occur under each of the alternatives in the long term.

Timber Rattlesnake

Timber rattlesnake populations are declining throughout most of Pennsylvania, primarily due to human-snake encounters and loss of suitable habitat (Urban 2005). Eight dens are known to exist on the ANF with the potential for a half dozen more (that are currently unknown). Under all alternatives, forestwide guidelines are designed to protect den sites with the goal of reversing the downward trend in populations.

The risk for human/snake interaction and harm to individual snakes is increased where roads or trails occur in suitable habitat. Road construction varies across the Alternatives and is based on levels of other resource activities, specifically vegetation management. Estimated annual averages, through the planning period, for road construction in existing corridors and new road construction is 13 miles and 8

Table 7. Suitable Goshawk Nest Habitat by Alternative

	2006	2060			
		Alt A	Alt B	Alt Cm	Alt D
Suitable Nest Habitat ¹	79%	71%	72%	73%	83%

¹ Suitable goshawk nesting habitat = Forests >30 yrs. old.

miles respectively under Alternative A, 14 miles and 7 miles under Alternative B, 13 miles and 5 miles under Alternative Cm, and 11 miles and 5 miles under Alternative D.

ATV/OHM/snake encounters and horse/snake encounters, increases the chance of snakes being purposely or accidentally killed. Alternative B includes the largest acreage in IUAs resulting in the highest risk of ATV/OHM-rattlesnake encounters. Alternative A provides the largest amount of open equestrian riding resulting in the highest risk of equestrian-rattlesnake encounters. Alternative D provides the least amount of ATV/OHM opportunities and open riding, reducing this risk.

Cerulean Warbler

Direct effects include any activity within suitable habitat that results in mortality or harassment leading to nest failure. Specific treatments include timber harvest, road and trail construction, oak release, and prescribed fire. Because the cerulean warbler is closely tied to oak and oak transition forests on the ANF, direct and indirect effects focus on changes in the oak forest community.

Available cerulean warbler habitat that will occur under each of the alternatives varies based on the mix of commercial treatments described above. Figure 5 displays the amount of optimum and unsuitable nest habitat created under each of the alternatives, as well as the amount of suitable oak habitat in the long term (2060).

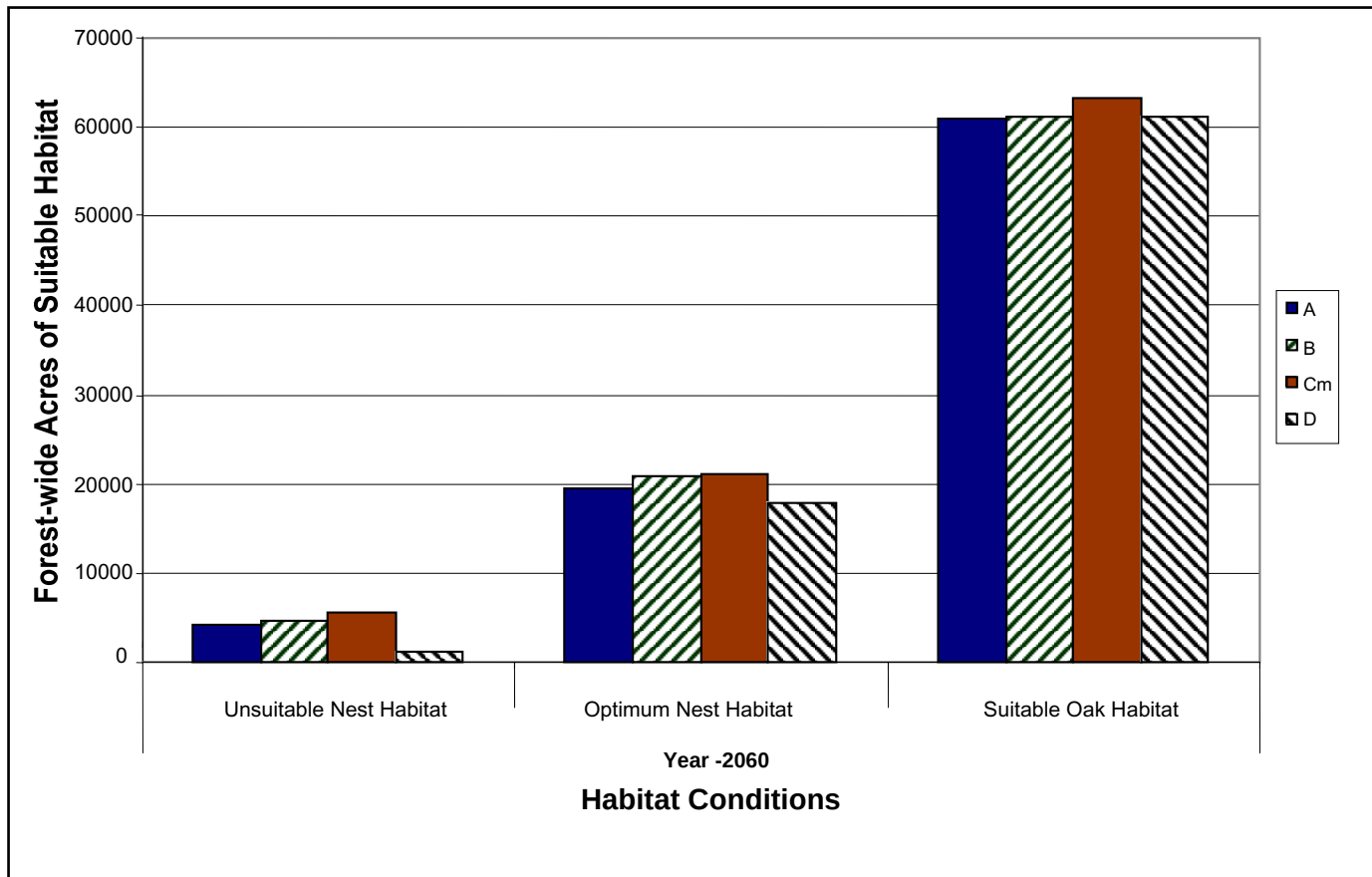


Figure 5. Cerulean Warbler Habitat by Alternative in the Year 2060

Mourning Warbler

The mourning warbler serves as an indicator of availability of early structural habitat. Proposed activities that would affect this species include timber harvest, new road and opening construction, herbicide application, and prescribed burning. Natural disturbances, such as wind events and insect and disease damage, can also create mourning warbler habitat by opening up forest canopies.

Table 8 shows the percent of the ANF that would provide suitable mourning warbler habitat through even-aged regeneration harvests and uneven-aged treatments, and the total percent of forest in suitable habitat by the sixth decade.

Table 8. Mourning warbler habitat by Alternative, 2060

Habitat	A	B	Cm	D
% ANF in early structural stage created by even-aged treatments	12.9	11.6	9.6	2.4
% ANF in multi-aged structure created by uneven-aged treatments	<1	0.5	0.7	2.0
Total percent ANF considered preferred habitat	13.0	12.1	10.3	4.4

Aquatic Invertebrates

Various activities associated with managing vegetation have the potential to indirectly affect aquatic invertebrates where the activity is located in close proximity to a stream. Runoff from logging activities that reaches a stream has the potential to affect habitat and embed cobble-size particles.

Dirt and gravel roads constructed within 300 feet have the highest potential for contributing sediment to a stream. These roads can become a long-term source of sediment and result in the embeddedness of cobble substrate, habitats important for aquatic invertebrates.

Game Species

Effects to game species habitat are influenced by the amount of early structural habitat, availability of mast from oak, beech, black cherry, and other species, and the impacts of human disturbance (primarily roads and motorized trails) on winter ranges and brood rearing habitat.

Early structural habitat will increase by 2060 under all alternatives except Alternative D. Under Alternative D, the quality and quantity of habitat for game species would generally decline from present conditions because of the decrease in early structural habitat.

Oak forests are important for a variety of game species including white-tailed deer, black bears, wild turkeys, ruffed grouse, squirrels, and others. An oak component will be provided on 16 to 17 percent of the ANF under all alternatives. However, by 2060 forested stands classified as the oak type (25% of basal area in oak) could decrease from 16 percent to 14 to 15 percent of the ANF in all alternatives.

Conifer habitat will be managed similarly under all alternatives providing winter thermal cover for deer

and turkeys. A conifer component will be provided on a minimum of 10 percent of the ANF.

Species with Viability Concerns

Beginning with a list of more than 300 animal species and more than 1,200 plant species known to occur on the ANF, all species were screened to identify 78 species with viability concerns using the best available data and in consultation with species experts.

The viability outcome is a judgment, based on scientific information found in the literature and from discussion with taxonomic experts. The viability outcome should be thought of as an index of the capability of the environment to support population abundance and distribution, but not as an actual prediction of population occurrence, size, density, or other demographic characteristics. A scale of five viability outcome levels was developed for use by Eastern Region National Forests for summarizing the existing conditions in the planning area and to document the species distribution, population trend, life history needs and threats:

Outcome A. Suitable ecological conditions are broadly distributed and of high abundance across the historical range of the species within the planning area.

Outcome B. Suitable ecological conditions are either broadly distributed or of high abundance across the historical range of the species within the planning area, but there are gaps where suitable ecological conditions are absent or only present in low abundance.

Outcome C. Suitable ecological conditions are distributed frequently as patches and/or exist at low abundance. Gaps where suitable ecological conditions are either absent, or present in low abundance, are large enough that some subpopulations are isolated.

Outcome D. Suitable ecological conditions are frequently isolated and/or exist at very low abundance.

Outcome E. Suitable ecological conditions are highly isolated and exist at very low abundance, with little or no possibility of population interactions.

Direct and indirect effects from Federal actions do not change outcomes by alternative for species that utilize primarily mid to late structural oak habitat, aquatic habitats, riparian/wetland habitats or grassland/seedling/sapling habitats for either the short (2020) or long term (2060). For mid to late structural habitat, there is one species, the timber rattlesnake, that has a reduced outcome in the long term. Table 9 displays long-term species viability outcomes for direct and indirect effects.

Timber rattlesnake – The outcome for the present condition of the timber rattlesnake is C. The viability

outcome does not change in the short term (2020). By the year 2060, the magnitude of adverse impacts due to increased human activities and road construction causes a decrease in viability outcome for Alternatives A, B, and Cm. However, under Alternative D, the viability outcome remains the same.

A number of species are expected to have declining viability outcomes associated with cumulative effects (Table 10). The species that experience a long term cumulative change in viability outcome from the present condition are described below.

Cumulatively, the outcome for timber rattlesnake decreases to outcome D under all alternatives in both the short and long term as a result of increased oil and gas development and road construction.

Table 9. Viability Outcomes: Direct and Indirect effects of alternatives

	Number of species (out of 77 total)				
	Existing Condition	Alt. A (2060)	Alt. B (2060)	Alt. Cm (2060)	Alt. D (2060)
Outcome A	0	0	0	0	0
Outcome B	24	24	24	24	24
Outcome C	30	29	29	29	30
Outcome D	22	23	23	23	22
Outcome E	2	2	2	2	2

Table 10. Cumulative viability outcomes by alternative

	Number of species (out of 77 total)				
	Existing Condition	Alt A (2060)	Alt. B (2060)	Alt. Cm (2060)	Alt. D (2060)
Outcome A	0	0	0	0	0
Outcome B	24	7	7	7	7
Outcome C	30	22	22	22	22
Outcome D	22	46	46	46	46
Outcome E	2	3	3	3	3

Northern flying squirrel – Only one location of the northern flying squirrel is currently documented within the proclamation boundary, although much of the potential habitat has not been adequately surveyed. The primary cumulative effect that would occur under all alternatives is the loss of hemlock due to the spread of the hemlock woolly adelgid. The cumulative outcome for the present condition is C; the outcome for all alternatives for both 2020 and 2060 is D.

Northern goshawk – Suitable habitat is presently fairly well distributed with some gaps in nesting habitat due to high density roads and oil and gas activity. Although recent nesting success has dropped for unknown reasons, the ANF has supported a fairly stable population for the last 15 years and there have been 12 active territories documented within the last five years. The current outcome for this species is B.

The change in outcome for the northern goshawk results from anticipated future oil and gas development. Although there will continue to be large areas on the ANF where oil and gas activity is not expected to occur, there are expected to be some large gaps in remaining suitable habitat. Additionally, up to 50 percent of the forestwide hemlock could be lost due to the HWA and for these reasons, the cumulative outcome C better reflects the viability of this species both in the short (2020) and long term (2060).

Swainson's thrush – Although the Swainson's thrush utilizes second growth forest, it is considered an obligate of conifer and mixed hardwood/conifer forest and is strongly associated with riparian/wetland habitat. Although conifer and preferred habitat is well distributed, this species has only been documented on approximately 20 percent of the sites surveyed on the ANF and the current viability for this species is outcome B.

The change in viability for this species is directly related to the potential loss of conifer that could occur as a result of the HWA. While it is estimated that only 10 percent of the conifer within the proclamation boundary could be lost by 2020, by 2060, mortality on up to 50 percent of the forestwide conifer could occur. As a result, and considering this species requirement for conifer, it is anticipated that by 2060, outcome C will better reflect the viability of this species because suitable ecological conditions may be distributed frequently as patches and because large gaps in suitable habitat may occur, further reducing its range within the planning unit from historical conditions.

Aquatic – Nine fish, eleven dragonflies, and twelve mussels are projected to have a decrease in the short- or long-term cumulative outcome from the present condition. This decrease is primarily a result of the projected influx of zebra mussels from Conewango Creek and the upper Allegheny River in New York into the ANF section of the Allegheny River where a large amount of suitable habitat exists for aquatic species with a viability concern.

Wood turtle and Eastern box turtle – The short- and long-term outcome for these two turtles decreases from the present condition primarily due to increased oil and gas activity that will adversely impact suitable habitat. Increases in miles of road would increase the risk of turtles being run over. Invasion of non native plant species into riparian areas would decrease habitat quality.

Plants – Of the 23 plant species evaluated with viability concerns, none change viability outcome by alternative or by length of effect for direct or indirect effects. However, one species—butternut (*Juglans cinerea*)—changed from a present condition of D to E for all alternatives under the cumulative effects analysis for 2060. This change is a result of a fungal disease (canker) for which there is no known cure.

Recreation

Providing for diverse recreation opportunities on the ANF was a key consideration in the design of alternatives. The LRMP provides for a continuation of developed recreation sites, so developed recreation opportunities do not vary substantially by alternative. The LRMP also contains an objective (that would be implemented in Alternatives B, Cm, or D) to prepare a plan to specifically identify recreational developments in the vicinity of the Allegheny Reservoir, including trails, facilities and potential for lodging or restaurant facilities. Many other recreation opportunities such as hiking, fishing, hunting, driving for pleasure, snowmobiling, boating, wildlife viewing, and most other recreational activities would also not be changed as a result of implementing any of the proposed alternatives.

There are three types of recreational opportunities that are affected by the alternatives. These opportunities are non-motorized recreation in semi-primitive or natural settings, motorized opportunities for all terrain vehicles (ATV) or off highway motorcycles (OHM), and equestrian opportunities. Each of these will be described individually.

Non-motorized Recreation

The current Forest Plan provides for the long-term retention of non-motorized recreation in semi-primitive settings only in specially designated areas (primarily in wilderness (MAs 5.1 and 5.2) or the national recreation area (MA 8.2)). The 1986 Forest Plan (Alternative A) did provide for MA 6.2 that was applied to four areas of the forest with the stated design of one entry for timber harvest in every 40 year period. Once the area had been harvested the roads would be converted to non-motorized trail use and the area closed to motorized access. This approach is not considered to adequately provide for semi-primitive recreation in a natural setting and was not carried forward into Alternatives B, Cm, and D.

Alternatives B, Cm, and D provide a new management area to provide for remote recreation settings for non-motorized recreation (MA 7.2) and one to provide for interpretive recreation (MA 7.3). Non-motorized recreation opportunities are also provided in the established Scenic (MA 8.3) and Research Natural Areas (MA 8.5) of the forest. Recommendations for wilderness study areas (MA 5.2) will also provide opportunities for non-motorized recreation. Alternatives Cm and D provide a greater emphasis on these recreation opportunities than Alternatives A and B. Table 11 displays the differences between the alternatives.

Table 11. Non-motorized recreation opportunities by alternative

	Alternative			
	A	B	Cm	D
Non-motorized recreation (Acres)	33,700	41,400	54,800	78,900

As the ANF does not own the subsurface rights to most of these acres there is a potential that portions of these acres could be roaded and developed for private oil and gas development. With such development, the opportunities and quality of these areas for non-motorized recreation would be diminished.

All Terrain Vehicle and Off Highway Motorcycle (ATV/OHM) Recreation

Alternative A continues the five intensive use areas (IUAs) established in the 1986 Forest Plan. The IUAs are areas where trails can be developed for ATV/OHM use. ATV/OHM use is only allowed on designated trails within the IUAs. IUAs are management area overlays. They are areas that consist of several management areas defined only for the purposes of managing ATV/OHM use.

Forest plans only identify areas that are suitable for ATV/OHM trail development and use. Project planning determines locations and other issues associated with specific trail segments.

All of the alternatives continue the IUAs on the ANF, but different amounts and locations of IUA opportunities are provided in each alternative as shown in the Table 12.

Table 12. Acres allocated to IUAs by alternative

	Alternative			
	A	B	Cm	D
Intensive Use Area (Acres)	99,000	113,000	83,200	40,500

Alternatives A and B provide for five IUAs on the ANF. Alternative B would replace the Westline area, included in the 1986 Forest Plan (Alternative A), with a new IUA in the Longhouse area. Alternative Cm provides slightly less acreage in IUAs than Alternative A with four IUAs (smaller versions of the areas in Alternative B without the Longhouse Area). Alternative D would reduce the amount of IUAs on the ANF and could lead to closure of some currently designated trails.

Equestrian Use

The 1986 Forest Plan did not specifically address equestrian use on the ANF. It essentially allows open riding across all of the ANF. Since the 1986 Forest Plan, several parts of the ANF have suffered resource damage from concentrated horse use. The ANF proposes to correct these problems in Alternatives B

and Cm by creating equestrian use areas (EUAs) in areas of concentrated equestrian use. Within EUAs, horse riding would be restricted to designated trails.

The ANF would work cooperatively with equestrian users to both restore currently damaged area and educate users to avoid creating further damage.

Most of the rest of the ANF in Alternatives B and Cm would be available for open riding except for a few management areas where riding would be prohibited and some where riding would also be restricted to designated trails. In Alternative D, EUAs are substantially expanded but are also the only area of the ANF other than on roads where horse use would be allowed. Table 13 summarizes the equestrian opportunities of the alternatives.

Table 13. Equestrian use opportunities by alternative

	Alternative			
	A	B	Cm	D
Equestrian Use Areas (Acres)	0	10,600	10,600	50,000
Areas for Open Riding (Acres)	506,500	470,100	456,700	0
Restricted Areas (Acres)	0	18,100	31,500	0
Prohibited Areas (Acres)	0	7,700	7,700	456,500

EUAs are also management area overlays. They are areas that consist of several management areas defined only for the purposes of managing equestrian use.

Special Areas

A key element of the design of the alternatives was to address specially designated or nationally designated areas. Specially designated areas are designated by the Congress or administratively. Creating or modifying a specially designated area requires a process beyond the forest planning process. The ANF only makes recommendations for designation in the Forest Plan. The ANF currently has the following types of these designated areas:

- Wilderness (Hickory Creek and Allegheny Islands) Congressionally designated (MA 5.1)
- National Recreation Area Congressionally designated (MA 8.2)
- Wild and Scenic Rivers (Allegheny and Clarion) Congressionally designated (MA 8.1)
- Research Natural Area (Tionesta) Administratively designated (MA 8.5)
- Scenic Area and National Landmarks (Tionesta and Heart's Content) Administratively designated (MA 8.3)
- Kane Experimental Forest Administratively designated (MA 8.6)

All of the alternatives will maintain these specially designated areas consistent with their designations. Roadless areas have also become a kind of special area due to the Roadless Area Conservation Rule.

As the ANF does not own the subsurface rights to nearly all of these areas being considered for special designation, there is a potential that parts of these areas could be roaded and developed for private oil and gas development. With such development the size and quality of these areas for these special designations would be diminished. The LRMP does contain an objective for acquisition of subsurface rights especially where acquisition supports the purpose and need in relation to recreation and special areas.

Most of the interest in specially designated areas on the ANF is in wilderness and roadless areas. This summary provides a discussion on wilderness, roadless areas and a brief discussion of the remaining special areas.

Wilderness

A substantial evaluation and analysis was done by the ANF in consideration of additional wilderness. This is detailed in Appendix C of the FEIS. Briefly, this analysis reviewed all large continuous blocks of land on the ANF to determine if they had characteristics for potential inclusion in the wilderness system. Included within this analysis were all of the areas recommended by the organizations that submitted comments on wilderness consideration. Among the criteria used in this analysis were the following:

- Boundary, shape and size of the area
- Opportunity for solitude or primitive and unconfined recreation
- Ability of the area to regain an untrammelled appearance
- Nature of existing improvements in the area
- Pattern of ownership
- Proximity of the area to various developments that impact on wilderness values
- Amount of improved road within the area
- Percent of the area that has been harvested or planted with non-native vegetation

Based upon this analysis, three areas were identified for further evaluation for possible recommendation as wilderness study areas. These areas are:

- Tracy Ridge (9,033 acres)
- Minister Valley (9,145 acres)
- Chestnut Ridge (5,063 acres)

In addition the Forest Supervisor decided to evaluate the Allegheny Front area (6,742 acres) for wilderness

study. The evaluation of each of these areas is also contained in Appendix Cm of the FEIS.

The four areas are allocated differently in each of the alternatives as follows:

Alternative A (1986 Forest Plan): None of the four areas are recommended for wilderness study. Two of the areas (Tracy Ridge and Allegheny Front) are managed as National Recreation Area (MA 8.2). Chestnut Ridge is managed in MA6.1 that conserves old forest habitat and manages timber on long rotations. Minister Valley is managed with several different management areas including MA 6.2 (see earlier discussion on non-motorized recreation), MA6.1, and MA3.0 that features even-aged management. Both Chestnut Ridge and Minister Valley would be available for scheduled timber harvest and road construction.

Alternative B: None of the four areas are recommended for wilderness study. Two of the areas (Tracy Ridge and Allegheny Front) are managed as National Recreation Area (MA 8.2). Chestnut Ridge is managed in MA3.0 that features even-aged management.

Minister Valley is managed with several different management areas including MA 7.3 that features interpretative recreation, MA 2.2 that features landscape linkages of late structural habitat and MA3.0 that features even-aged management of timber. Chestnut Ridge and MA3.0 portion of Minister Valley would be available for scheduled timber harvest and road construction.

Alternative Cm: Chestnut Ridge and Minister Valley east of FR420 are recommended as wilderness study areas. Tracy Ridge is managed as National Recreation Area (MA 8.2). Minister Valley west of FR420 (1,829 acres) is allocated as MA 3.0.

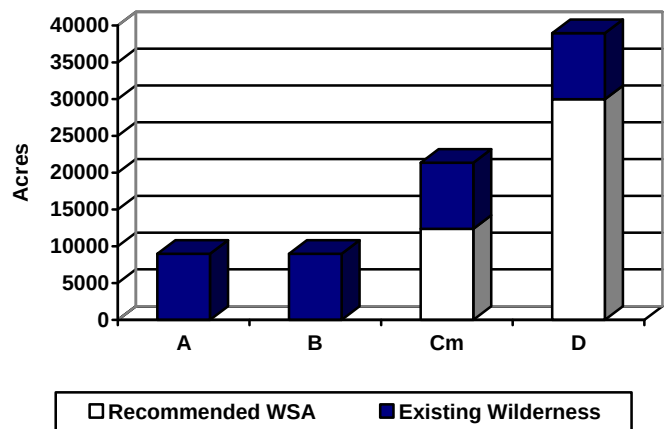


Figure 6. Wilderness and wilderness study are recommendations

Alternative D: All four of the areas are recommended as wilderness study areas. None of the four areas would be available for scheduled timber harvest or road construction.

Roadless Areas

Roadless areas on the ANF were originally inventoried during the 1970s as part of the Roadless Area Review Evaluation (RARE II) process. These areas have not been re-inventoried until this Forest Plan revision as described in Appendix C of the FEIS and summarized in the previous section of this summary.

As of December 2006, the Roadless Area Conservation Rule is in effect. Alternatives B, Cm, and D were developed to conserve these roadless (RARE II) areas.

The RARE II inventory for the ANF is available online at <http://www.roadless.fs.fed.us>. Due to interest in these RARE II areas, this section will describe briefly the impact of the alternatives on these areas.

During RARE II, the following areas were inventoried on the ANF:

Hickory Creek	9,337	
Allegheny Islands	368	
Tracy Ridge	9,188	
Cornplanter	3,012	
Clarion River	3,440	
Allegheny Front	7,424	
Minister Valley	1,375	
Heart's Content	200	
Verbeck Island	<u>14</u>	
	34,358	acres

Hickory Creek and the Allegheny Islands were designated as wilderness by the Pennsylvania Wilderness Act of 1984, reducing the remaining roadless areas to 24,653 acres. The Cornplanter, Allegheny Front, and Tracy Ridge areas were designated as the Allegheny National Recreation Area by the same act. These areas are not available for scheduled timber harvest or Forest Service road construction in all alternatives.

Clarion River area is managed with MA 6.1 in the 1986 Forest Plan (Alternative A). MA6.1 conserves old forest habitat and manages timber on long rotations. This includes scheduled timber harvests and allows new road construction. Under Alternatives B, Cm, and D, this area is managed as a remote recreation area (MA 7.2) in which scheduled timber harvest and road construction would not be allowed.

Minister Valley is a much smaller area in RARE II than it is in the new inventory for potential wilderness previously described. The Minister Valley area is managed with MA 6.2 (see earlier discussion on non-motorized recreation) and MA6.1 in Alternative A. Both scheduled timber harvest and road construction is allowed. In Alternative B, the area is managed for an interpretive recreation emphasis (MA 7.3), and in Alternatives Cm and D,

for wilderness study area (MA 5.2). In all three of these alternatives (B, Cm, and D), scheduled timber harvesting and Forest Service road construction would not be allowed in the RARE II portion of Minister Valley.

Hearts Content is managed as a Scenic area and National Landmark (MA 8.3) in all alternatives. This does not allow scheduled timber harvest or Forest Service road construction.

Verbeck Island is managed in the Wild and Scenic River management area (MA 8.1) in all alternatives. This is not available for scheduled timber harvest and road construction is not allowed on islands in this management area.

When the Forest Plan revision is completed, the roadless area inventory for the ANF will be replaced with the new inventory previously described under Wilderness. Thus the ANF will have three roadless areas (Tracy Ridge, Chestnut Ridge, and Minister Valley) totaling 23,241 acres.

Other Special Designations

The FEIS does not propose changes to most of the other existing special designations on the ANF. A brief summary follows for each designation with changes proposed in the alternatives.

Wild and Scenic Rivers are changed by creating a separate management area for them in Alternatives B, Cm, and D. This management area does not allow scheduled timber harvest, although it does allow harvest for a number of other purposes. The ANF also examined the potential for additional rivers since the previous Forest Plan due to changed conditions. This is described in Appendix D of the FEIS. The conclusion was that no other rivers merited further consideration at this time.

There are no changes recommended to the National Recreation Areas. Where Tracy Ridge and Allegheny Front are recommended for wilderness study areas,

they will have a dual designation of National Recreation and Wilderness Study area.

For the Buckaloons Historic Area, Alternatives B, Cm, and D propose to establish this area as a nationally designated area in the Forest Service system of Special Interest Areas.

An expansion of the Kane Experimental forest from 1,737 acres to 3,463 acres is proposed in Alternatives B, Cm, and D.

Other Effects

Transportation Resources

Road construction, maintenance, and decommissioning under each alternative are designed to provide full access to all necessary MAs for full implementation of each alternative. The road system is designed to:

- Minimize the number of perennial and intermittent stream crossings
- Minimize the length of road crossings on poorly drained soils
- Utilize existing road corridors as much as possible
- Minimize the use of rights-of-way
- Minimize crossing MAs that exclude roads to access MAs that require additional access

The total Forest Service road system is largest in Alternative A, with declining levels to lowest in Alternative D. At the end of the first decade, the total road system in Alternatives A and B could expand over the current level by 15 percent; in Alternative Cm by 13 percent; and in Alternative D, by 10 percent. These additional roads will generally be Maintenance Level 1 or 2 roads, closed or restricted for public use. Many of these roads will be existing private oil and gas roads added to the Forest Service road system.

In all alternatives, protection of soil, aquatic, and riparian systems would be given more attention in future road operations. Effects of road operations on soil, and water resources, and on habitat diversity are discussed in corresponding sections of the FEIS. The ANF would expect some beneficial effects (e.g. reduced erosion and sedimentation) when roads are resurfaced or decommissioned under all alternatives.

Air Resources

Although the majority of the area's pollution comes from sources outside the National Forest, activities within the ANF's boundaries can also affect air quality in the region. Timber harvesting, oil and gas development, road construction and use, ATV/OHM use, and prescribed burning were all considered in the analysis of effects on air resources.

Briefly, effects on air resources do not vary by alternative. Administrative vehicle use and visitor vehicle use produce volatile organic compounds and nitrogen oxides, but use will not vary by alternative. Both herbicides used in all alternatives have a low volatility, are being applied from the ground, and are being applied in relatively small amounts. Therefore, effects on air quality would be minor, short-term, and localized. Neither herbicide is expected to contribute to soil acidification. Annual emissions from prescribed fire and timber harvest activities, and ATV/OHM use, are well below the regional pollution contribution threshold of 5 percent in all alternatives and therefore are not a major concern.

Water Resources

The analysis of direct, indirect, and cumulative effects on water resources considers effects of Forest Service activities such as vegetation management, reforestation treatments (i.e. use of herbicides and fertilizers), road construction, and ATV/OHM and equestrian use on water quality and quantity. Standards and guidelines for all of these activities,

especially activities conducted in riparian areas, minimize adverse effects on water resources.

Alternatives B, Cm, and D are all expected to protect water and riparian conditions. These alternatives also provide more direction for protection of springs, seeps, vernal ponds, and other wetlands. Alternative A would have slightly less-restrictive standards and guidelines for perennial streams and floodplains, but would most likely achieve adequate protection.

Forest Service management activities such as road construction, timber harvesting activities, and recreation activities have the potential to result in sedimentation of aquatic and riparian habitat. In order to accomplish short-term and long-term land management activities, sediment transport may be an unavoidable consequence. However, standards and guidelines integrated into all alternatives minimize direct, indirect, and cumulative effects to watershed integrity. Since ANF standards and guidelines will meet or exceed Pennsylvania Department of Environmental Protection Best Management Practices, they will meet the goals of the Clean Water Act.

Acres of herbicide treatments for reforestation are not expected to have an adverse effect on water quality in any of the alternatives.

Cumulatively, increased road construction for oil and gas development has potential to lead to increases in sedimentation and decreases in streamflow that do not vary substantially by alternative.

Soil Resources

Concerns about soil resources revolve primarily around three issues: nutrients, erosion, and compaction (including puddling and rutting). There are concerns that management activities, such as harvesting, fertilizer use, road construction, and ATV/OHM and equestrian use could contribute to adverse effects on soil resources.

Alternative A has the greatest potential for nutrient loss, although anticipated effects would be minimal. Construction of roads, pits, and buildings causes a long-term change to soil structure and nutrient holding capability. The total Forest Service road system is largest in Alternative A, with declining levels to lowest in Alternative D. Pit development does not vary by alternative. Nitrogen-based fertilization has potential to increase leaching of base cations from the soil, and Alternative A has the greatest potential for use of nitrogen-based fertilizer.

The effects of vegetation management on erosion and compaction vary only as much as levels of harvest vary across alternatives. Temporary erosion from even-aged management will be greater than temporary erosion from uneven-aged management, but due to the repeated entries required by uneven-aged management, long-term erosion resulting from vegetation management is expected to be similar for all silvicultural systems. Potential compaction is also expected to be similar for all silvicultural systems. Standards and guidelines in the 1986 Forest Plan and the LRMP, and adherence to state Best Management Practices, moderate effects of vegetation management on soil resources.

Alternative A has the greatest potential for new road construction, and therefore the greatest risk of soil erosion from this activity. Overall, Alternative D has the lowest potential erosion from all Forest Service activities proposed during the planning period; Alternative D has the lowest suitable acreage with severe erosion potential, the lowest number of potential new FS roads on severe erosion soils, and the lowest existing FS roads on severe erosion soils, the lowest acreage in IUAs on severe erosion soils, and no open equestrian riding.

Cumulatively, OGM development and road construction are expected to have the greatest effect on soil resources, in terms of increased erosion and compaction and long-term commitment of soil

nutrients. Another cumulative effects concern is the effect of acid deposition on soil resources. Although the amount of acid deposition has been decreasing in the region, it is likely to continue to contribute to leaching of base cations from the soil. There is uncertainty over the cumulative effects from acid deposition on soil and water resources. A study of the changes in soil nutrients and pH over a 30-year period beginning in 1967, showed statistically significant reduction in exchangeable calcium and magnesium concentrations and pH throughout the soil profile.

Scenery

The LRMP and Alternatives A, B, Cm, and D adopt the new Forest Service Scenery Management System to provide a consistent approach to managing scenery across the ANF. Standards and guidelines include a range of mitigation measures to minimize the effects of management activities on scenic integrity. Vegetation and recreation activities are most likely to affect scenic integrity on the ANF.

Even-aged timber harvests are “high-impact” zones with the greatest potential to effect on scenery. Alternatives A and B, and Alternative Cm to a lesser extent, emphasize even-aged management. Alternative D harvests are characterized by smaller openings that emphasize uneven-aged management or no active management. These “low-impact” zones have a minimal effect on scenery.

Mitigation measures are applied to lessen the effects of harvest and regeneration activities. Fencing and herbicide effects on scenery are generally temporary, however, oil and gas activity by private oil and gas

operators could double across the landscape, resulting in a roaded forest setting that is more modified than in the past.

Economics

The four Pennsylvania counties surrounding the ANF (Elk, Forest, McKean, and Warren counties) have long had portions of their economies linked to natural resource industries especially production of lumber and wood products and oil and natural gas. Manufacturing has become the most important economic sector for jobs and income in the four-county area, but the amount of manufacturing activity has been in decline. Retail and wholesale trade, services and other economic sectors that are in part supported by recreation and visitation to the ANF region have increased in their economic importance.

The primary contributions made by the ANF to the four economies is through provision of recreation activities, providing timber resources, payments to local governments and school districts, and direct expenditures of the ANF and its staff within the local economy. With full implementation of the alternatives under consideration, all of the alternatives have the potential to contribute to greater employment and income and increase the level of payments to local governments. Table 14 provides an estimate of the potential annual contribution in employment and labor income that could be made by the ANF under each of the alternatives as compared to the condition of the last 5 years. The table also shows the estimated level of payments to local governments and schools under the 25 Percent Fund and Secure Rural School Act.

Table 14. Potential economic impacts

		Alternative			
	2001-2005	A	B	Cm	D
Jobs (total jobs)	1572	2645	2572	2345	1726
Labor Income (million dollars)	46.1	87.8	85.0	75.9	51.1
Payments to Local Governments (million dollars, 25% Fund)	5.6	17.3	16.1	13.4	6.9
Payments to Local Governments under Secure Rural Schools Act (million dollars)	5.6	6.4	6.4	6.4	6.4

In a cumulative context, oil and gas extraction on the ANF also makes a substantial contribution to jobs and income in the local economy. Increased oil and gas development is expected to support even higher levels of local employment.

Recreation activity on the ANF is not expected to substantially increase. However, if recreation based

economic development initiatives such as Pennsylvania Wilds are successful, there could be further increases in jobs and income based upon this increased visitation.

The potential contribution of the ANF to the four counties will not offset continued substantial decline in the manufacturing sector.

Preface

Final Environmental Impact Statement



Cover photo courtesy of US Forest Service

This page intentionally left blank

Preface

Organization of the Final Environmental Impact Statement

The Allegheny National Forest (ANF) has prepared this Final Environmental Impact Statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant laws and regulations. This FEIS documents the effects of implementing various management options on the ANF. The FEIS is the basis for determining what changes were made to the revised Forest Land and Resource Management Plan (LRMP) for the ANF. The FEIS is presented in four volumes.

Volume 1 is organized as follows:

- **Summary** – The executive summary provides an overview of the FEIS.
- **Preface** – This chapter introduces the reader to the development of the LRMP and FEIS. It describes in general terms where the ANF is located, what the environments of the ANF are today, and the historical and contemporary uses of these areas. It also includes the applicable laws, regulations, and direction that national forests must follow when completing Forest Plan revision.
- **Chapter 1 – Purpose, Need, and Public Involvement.** This chapter describes legal reasons for Forest Plan revision; decisions made in the Forest Plan; the purpose and need for change, the environmental analysis and decision-making process, public involvement and significant issues used to develop alternatives.
- **Chapter 2 – Alternatives.** This chapter describes the process used to develop alternatives, lists important points common to all alternatives, gives a general description of each alternative, describes and explains why some alternatives were not considered in detail, and provides a comparison of the alternatives considered in detail. It also identifies the preferred alternative.
- **Chapter 3 – Affected Environment and Environmental Consequences.** This chapter describes the direct, indirect, and cumulative effects of implementing the alternatives considered in detail.
- **Chapter 4 – List of Preparers**
- **Chapter 5 – FEIS Recipients**
- **Chapter 6 – Glossary**
- **Chapter 7 – Reference List**
- **Chapter 8 – Index**

Volume 2 – Appendix A, Volume 3 is Appendices B-F, and Volume 4 contains Appendix G. These volumes provide detailed information to support the analyses presented in the FEIS.

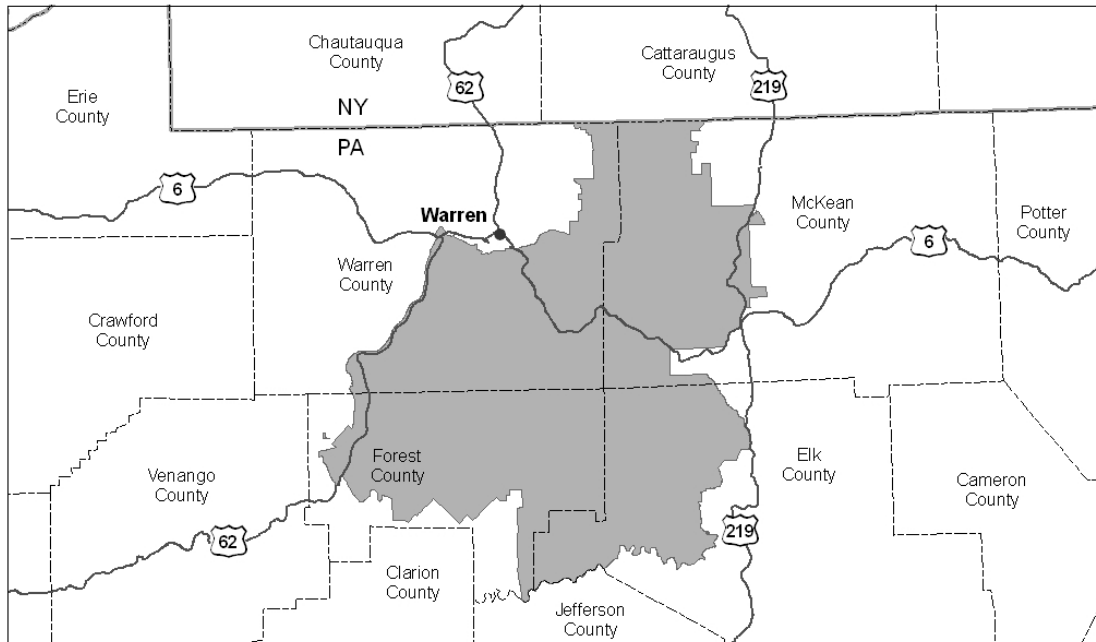
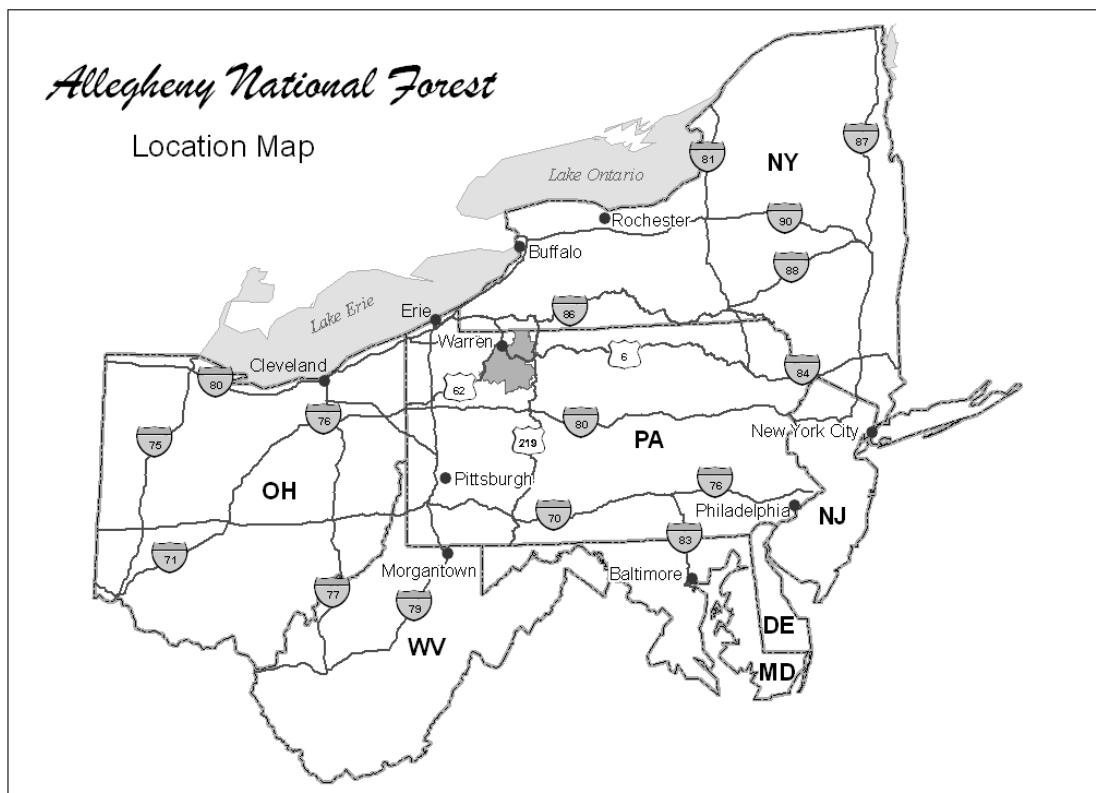


Figure P-1. Allegheny National Forest Location Map

Forest Niche/Historical Perspective

The Allegheny Plateau was once a vast forest dominated by eastern hemlock and American beech growing on ridge tops and mammoth white pine and oak growing along the slopes and bottoms of the Allegheny River valley. The Allegheny Plateau was profoundly transformed by industrialization and consequent unregulated logging beginning in the early 1800s when the first European settlers reached the area and continuing into the 1900s with the advent of the wood chemical industry. The once vast forest of the Allegheny Plateau was almost completely removed, leaving barren, brush covered hillsides as far as the eye could see. By 1900, deer and their predators were almost completely eliminated due to unregulated hunting and loss of habitat.

The Weeks Act, passed by Congress in 1911, allowed the Federal Government to buy land in Eastern United States for the establishment of national forests. The Allegheny National Forest was established in 1923. The land was so depleted of large trees that many residents jokingly called it the “Allegheny brush patch.” Some worried the forest would never recover, but a healthy, diverse forest started to grow. The Forest Service began to manage the land and brought new concepts in forest management to the Allegheny Plateau – multiple benefits and sustainability. By the 1940s, the forest began to take on an appearance of a healthy maturing forest and the Forest Service gradually resumed timber harvesting under strict, research-based guidelines to ensure sustainability for future generations.

The Allegheny Today

The ANF fulfills many ecological and social functions and continues to evolve as an important component of the Commonwealth of Pennsylvania. From the high points and ridgelines of the Allegheny Plateau to the river bottoms and stream valleys below, the ANF provides unique opportunities for watershed protection, plant and animal habitats, cultural history, recreation, wood products and research, not only today but for generations to come.

A Vital Watershed

As a result of industrialization and widespread unregulated logging of the Allegheny Plateau, many rivers and streams were threatened by intense pollution and channel instability. President Calvin Coolidge recognized the importance of watershed health and established the ANF with the aim of restoring and protecting the Allegheny River watershed. Since that time, conservation efforts to protect and restore the Allegheny River watershed led to a remarkable recovery of the Allegheny and Clarion rivers. This recovery resulted in their designation as wild and scenic rivers for having outstanding scenic, natural, recreational, scientific, historic, ecological and fisheries resource values. Protection of the Allegheny River watershed is one of the most important conservation efforts in the Commonwealth and the region. The ANF is uniquely positioned to help contribute to continued watershed conservation efforts.

A Home to Native Plants and Animals

The ANF supports a rich diversity of plants and animals and is part of the Allegheny High Plateau Ecoregion of Pennsylvania. This ecoregion has been described by the Pennsylvania Department of Conservation and Natural Resources as “having the highest stream quality for the state with the largest block of core forest state-wide.” The region hosts critically important concentrations of forest wildlife. Included are two important bird areas that focus on quality habitat for the yellow-bellied flycatcher (endangered species in Pennsylvania) and a host of woods warblers and an important mammal area that recognizes the quality of habitats for river otters, fishers, and northern flying squirrels. While early structural habitat declined across Pennsylvania and the region, the ANF has maintained this community on approximately 8 percent of the forest for the past 20 years. The forest habitats and river systems of the Allegheny provide refuge for an abundance of game species creating outstanding opportunities for hunting and fishing. Approximately 4,000 acres of remnant, original forest remains. Although this makes up less than 1 percent of the total ANF acreage, it comprises approximately 12 percent of the total old growth forest in Pennsylvania, and is the largest contiguous old growth beech-hemlock forest in the Northern United States.

A Place to Play

The ANF provides 108 miles of premier all-terrain vehicle/off-highway motorcycle trail riding opportunities, one of the most extensive systems within the Commonwealth of Pennsylvania. The ANF is also a premier destination for equestrians as Pennsylvania has the fifth largest number of avid recreational riders in the United States. Water-based recreation opportunities abound on the popular 8,000-acre Allegheny Reservoir and along the Wild and Scenic Allegheny and Clarion rivers. The Allegheny Reservoir offers outstanding scenery along its vast undeveloped shoreline and wooded uplands. Many easily accessible opportunities exist for developed or remote dispersed recreation across a lush forested landscape and within special areas, including federally designated wilderness areas, National Recreation and Scenic Areas. A rich heritage, ranging from early settlement by native peoples to the lumber and oil era, contributes to the interpretive and educational values that distinctively enhance the recreation opportunities on the ANF.

Working Woodland

The ANF is managed to sustain or improve forest ecosystem health and provide sustainable supplies of high quality timber and other forest products to present and future generations. Sustainable forest management includes a range of reforestation activities designed to help ensure adequate tree seedlings develop where deer herbivory and interfering plants limit their establishment or survival. Allegheny hardwood stands include black cherry, yellow poplar, white ash, and a wide variety of other species and represent the most economically valuable forest type in the eastern United States. The exceptional quality of the black cherry and other hardwoods found here makes it highly valued throughout the world for fine furniture and veneers. Millions of board feet of timber are harvested from the ANF annually, providing jobs for people involved in making a variety of wood products and furniture. For many rural communities, forest industries are key to the economy and cultural heritage.

The ANF lies in the heart of Pennsylvania's oil and gas region, only 40 miles from the site of the first oil well in the United States. Much of the Commonwealth's crude oil production comes from mineral rights owned by private individuals within the forest boundary each with an estimated 8,000 active wells. Because of its high paraffin content, Pennsylvania crude is one of the best lubricating oils in the world. The oil heritage plays a unique role in the settlement of the East and in history.

The Research and Experimental Forest

Since the 1920s, the Forest Service has conducted research on and around the ANF. The Northern Research Station's Warren Forestry Sciences Laboratory, located in Irvine, PA, performs high quality basic and applied research on the forested ecosystems of the Allegheny Plateau and adjacent regions, with an emphasis on underlying principles to increase the applicability of results across the widest possible region. Its aim is to develop enhanced ecosystem management methods that incorporate new science and encourage ecologically sustainable forest and vegetation management. To accomplish this mission, research is carried out across the ANF with three areas having special significance. The 4,000-acre Tionesta Scenic and Research Natural Areas contain one of the largest old growth remnants in the East. Research on the 1,737-acre Kane Experimental Forest focuses on understanding and managing forest ecosystems of the Allegheny Plateau region. The 220-acre Hearts Content Scenic Area is a National Natural Landmark recognized for its old growth and scenic qualities. It has been studied since the 1920s. As a research base for forest experimental study, the ANF is a proving ground for forestry practices and demonstration areas of what has been determined to be the best management of woodlands.

Planning Laws

Forest Service planning activities are guided by several key federal laws. Under the Multiple-Use Sustained Yield Act of 1960 and the National Forest Management Act of 1976 (NFMA), National Forest Service lands are managed for a variety of uses on a sustained basis to ensure a continued supply of goods and services to the American people. The NFMA amended the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) to specify that land and resource management plans (forest plans) be developed for units of the National Forest System. NFMA also specifies that plans are developed consistent with NEPA.

National Forest Management Act Regulations (36 CFR 219, 1982 version)

The NFMA regulations establish analytical and procedural requirements for the development, revision and significant amendment of Forest Plans. NFMA regulations describe procedures for formulating and evaluating alternatives and require that alternatives consider a full range of resource outputs and expenditure levels. NFMA regulations also acknowledge the need to comply with other laws such as the Endangered Species Act, Clean Water Act, National Historic Preservation Act and the Archeological Resources Protection Act.

NFMA requires forest plans to be revised every 10 to 15 years. Although it has been more than 15 years since the Allegheny Forest Plan was approved, Congress passed P.L. 108-108, which states that the Secretary of Agriculture will not be considered in violation of NFMA if more than 15 years have passed without a revision to a Forest Plan providing that the Forest Service is acting expeditiously and in good faith.

National Environmental Policy Act

NEPA brought environmental analysis and public participation requirements into planning of federal activities. NEPA ensures that environmental information is made available to public officials and citizens before decisions are made and before actions are taken. The goal is to help Forest Service officials base their decisions on an understanding of environmental consequences and to take actions that protect, restore and enhance the environment. Accurate scientific analyses, expert agency input and public scrutiny are essential to the NEPA process.

Allegheny National Forest at a Glance

- Established in 1923
- Current acreage: about 513,325
- Within a days drive of 1/3 of the Nation's population
- 95% forested with 2nd growth maturing hardwood forest
- Three primary forest health threats affect hemlock, beech, and sugar maple
- Kinzua Dam:
 - Completed in 1965
 - Administered by the U.S. Army Corps of Engineers
 - Impounds the 12,080-acre Allegheny Reservoir
- Campgrounds – 16 with over 600 sites
- Trails:
 - Hiking 201 miles
 - Cross-country skiing 53 miles
 - Interpretive 18 miles
 - All-terrain (ATV) 106 miles
 - Allegheny Snowmobile Loop System 366 miles
- Roads on the ANF
 - Forest Service 1270 miles
 - State and Township..... 281 miles
 - Oil, gas, minerals (estimated, not managed by ANF)..... 1236 miles
- Minerals rights: 93% are owned by someone other than the Federal Government
- Producing oil and gas wells were estimated at approximately 8,000 in 2005
- Average acreage harvested annually since 1987: 5,614 acres (1.1% of the total ANF acreage)
- Primary method of timber treatment is thinning (annual average since 1987 of 5,103 acres), followed by final harvest (1,908 acres) and selection cuts (396 acres)
- Deer herd:
 - Deer density has been above 20 deer per square mile for more than 3 decades
 - With the implementation of the PA Game Commission Deer Management Strategy in 2001, the deer density has dropped to between 10 to 15 deer per square mile
 - This drop has been accompanied by a slight improvement in habitat conditions
- Six Federal Threatened or Endangered Species are known to occur or there is suitable habitat within the Forest:
 - Bald eagle
 - Northern riffleshell (mussel)
 - Clubshell (mussel)
 - Indiana bat
 - Small-whorled pogonia (orchid)
 - Northeastern blurrush

There are also two candidate mussel species: known to occur within the Forest: sheepsnose and rayed-bean
- Streams on the ANF:
 - About 770 miles of perennial cold-water streams
 - 43 miles are classified as warm-water fisheries

Chapter 1

Purpose, Need, and Public Involvement



Photo courtesy of US Forest Service

This page intentionally left blank.

1 PURPOSE, NEED, AND PUBLIC INVOLVEMENT

The following changes have been made to Chapter 1:

Purpose – The effects analysis in the FEIS is displayed by decade 1 and decade 2 rather than by the planning period displayed in the DEIS.

Other Areas of Concern – Changes to oil and gas management were made.

1.1 Purpose

The Allegheny National Forest (ANF) proposes to revise its Land and Resource Management Plan (hereafter referred to as “Forest Plan” or LRMP) as required by the National Forest Management Act (NFMA) of 1976. The Forest Plan was originally approved in 1986 and has been amended 14 times to incorporate new information and to address changed conditions. The revised LRMP accompanies this document.

This Final Environmental Impact Statement (FEIS) describes four alternatives for revising the 1986 Forest Plan and discloses the potential environmental effects of these alternatives. The effects analysis for this FEIS is displayed by decade for decades one and two.

1.2 Need for Action

The ANF is revising its 1986 Forest Plan to meet the legal requirements of NFMA and to incorporate new scientific knowledge on topics including ecological information, vegetation management, species viability, soils, insects and diseases, known changes in forest conditions, and recreational user trends and preferences.

The ANF interdisciplinary team (IDT) identified three major areas of the 1986 Forest Plan that needed change to address preliminary issues.

1.2.1 Vegetation Management Need For Change

This revision sets forest type composition and vegetative structural/age class goals and objectives; adds forest health strategies to address new threats; updates human health and wildlife risk assessments for herbicide use; incorporates new information on silvicultural and reforestation techniques for forest types found on the ANF; and redefines uneven-aged management criteria and appropriate uses. It also assesses land suitability, and adjusts the allowable sale quantity (ASQ) with information from the Analysis of Timber Harvest Program Capability Report for 1995-2005 (USDA FS 1995).

1.2.2 Habitat Diversity Need For Change

Under this revision, there is a need to add direction to maintain proper spatial and temporal arrangements of habitats, including early, mid, and late stand structures and habitat connectivity. This revision evaluates viability of native and desired non-native species; conserves habitat for federally-listed threatened, endangered, and sensitive species; adds control strategies for invasive species; and evaluates landscape-level wildlife/habitat relationships.

1.2.3 Recreation and Special Area Designations Need For Change

Recreational uses of the forest need to be addressed due to changes since 1986. This revision clarifies direction for developed facilities management; improves direction for management of dispersed recreational trails and camping sites; provides semi-primitive and remote types of recreation based on resource capability and compatibility of uses; aligns intensive use areas (IUAs) for motorized trails based on resource capability and compatibility of uses; and adds direction for managing equestrian use. For special areas, this revision contains a roadless area inventory and evaluation of potential wilderness (recommendations to Congress may be made for potential wilderness study areas); clarifies Wild and Scenic River Management direction to reflect new information and understanding about river protection and management; considers opportunities to expand or designate new special areas such as National Recreation Areas or Scenic Areas; and adds new Management Areas to better define desired conditions, goals, and objectives for recreation and special area management.

1.2.4 Other Resource Areas

The IDT also identified a need to clarify and strengthen guidance in the Forest Plan for seven other resource areas, in order to bring the new Forest Plan into alignment with the 2004-2008 Forest Service Strategic Plan and desired settings. These include:

1. Soil and Water Quality – Update soil and water goals, objectives, standards, and guidelines for resource protection and add riparian area prescriptions to address riparian values to sustain over time and space.
2. Heritage Resources – Update standard and guidelines to incorporate all current laws and regulations to enhance consultation with state and tribal historic preservation offices and address changing conditions with respect to archaeological sites.
3. Scenery – Map and define new scenery objectives to integrate benefits, desires, and preferences for aesthetics with other resources using updated scenery planning tool.
4. Transportation Systems – Reset road management goals (open, closed, and restricted)
5. Monitoring – Realign monitoring to enable determination of the adjustments needed for achieving desired outcomes

6. Management Areas – Add management area descriptions for greater clarity of desired settings and outcomes. Realign sub-listing categories on compatibility and management intent and drop designations not moving toward desired conditions.
7. Reorganization of Forest Plan Format – Use the National Model for Forest Plans completed in 2004.

The 1986 Forest Plan management direction not needing revision has been reformatted and incorporated, or affirmed by the LRMP.

1.3 Scope of Plan

Issues raised by the public were evaluated to determine whether they fell within the scope of forest plan revision.

1.3.1 Items Outside the Scope of the Plan That Do Not Constitute a Need For Change

Not all issues raised by the public are applicable to forest plan revision. For example, appeals and litigation processes, creation of jobs and community stability, and site specific improvements which are addressed by project implementation of the plan, are not applicable forest plan issues. These issues are not addressed in the revised plan.

1.3.2 Items Within the Scope of the Plan That Are Not Addressed

The following listed items were identified in the NOI, but are not addressed in this revision:

1. Development of a Clarion River Management Plan with river corridor boundaries – A plan for Clarion River management will be completed under separate analysis and processed in a forest plan amendment. There was not sufficient funding or time to initiate this study at this time.
2. Creation of a riparian management area – Riparian areas occur throughout the forest, making identification of a specific riparian management area difficult. The IDT determined that new management direction in goals, objectives, standards and guidelines were sufficient to address riparian area protection and enhancement.
3. Development of a systematic framework of criteria and indicators to assist in monitoring management outcomes – This approach was not instituted, but a revised monitoring plan is included. The 2004 Planning Rule has adopted an adaptive monitoring structure, which will be transitioned into over the next few years. This structure is called an environmental management system and follows an established international framework.

1.3.3 Items within the Scope of the Plan that are Addressed

Impacts created from development of private mineral rights (oil and gas) are analyzed by resource area and in the cumulative effects sections of Chapter 3. Adjustment of management area boundaries have been made where extensive development has occurred to align management areas with desired future settings. Limited acquisition of mineral rights may be pursued in specific areas where needed to achieve surface management objectives.

1.4 Proposed Action

The revised ANF Land and Resource Management Plan (LRMP) is based on Alternative Cm.

1.5 Decisions to Be Made

The ANF has chosen to narrow the scope for revising the forest plan by focusing on issues identified in the Need for Action section above as being most critically in need of change at this time. For a discussion of the process used to narrow the range of Forest Plan revisions, please see the document entitled “Analysis of the Need for Change in Forest Plan Revision.”

The NFMA provides direction for the decisions that are made in a forest plan. For this plan revision the Allegheny is using the Forest planning rule in place prior to November 9, 2000, as permitted by section 219(e) of the current planning rule (36 CFR Part 219, January 5, 2005). The elements below organize the decisions to be made in the forest plan based on their intent and sheds light on how they function together (also see Forest Plan Introduction).

Decisions that express an aspiration and form the basis for projects, activities, and uses that occur under the plan.

Desired Conditions – This describes a future that is the long term goal of the plan. The description identifies desired forest uses, ecological conditions, and forest infrastructure.

Goals – Identify a future condition or accomplishment to be achieved. They are generally written in broad general terms.

Objectives – These are concise, usually time-specific statements of measurable planned results.

Decisions that set requirements to limit or guide the forest uses or activities that are expected to occur under the plan.

Suitability – This is a basic description of what uses and resource management practices are appropriate on what type of land. Suitability determinations in the plan identify lands as suitable or not suitable for a particular use or management activity, subject to the design criteria of the plan (or by Management Area).

Design Criteria (standards and guidelines) – These provide technical information and direction guiding uses and activities of the forest. They are sideboards that impose limitations on activities or uses for reasons of environmental protection, public safety, risk reduction, or to achieve a desired condition or objective.

The allowable sale quantity (ASQ) is also a forest plan decision. The ASQ is the upper limit for the timber harvesting schedule.

Decisions that identify management areas that allocate zones of the forest to different desired conditions and uses (much like local municipal zoning regulations). Special designations or recommendations for special designations, are specific decisions to establish a specific type of area (e.g., a recommendation to create a wilderness study area.

Management Areas (MAs) and Special Designations – management areas are spatially identified areas of the forest. Management areas may be assigned their own set of desired conditions, goals, objectives, suitable uses and activities, and standards and guidelines. The plan also makes recommendations for the establishment through legislation of congressional designations; such as wilderness study areas, National Recreation Areas, Wild and Scenic Rivers. These designations, along with administrative designations such as Research Natural Areas, Experimental Forests, Historic Areas and Scenic Areas, usually are assigned their own Management Area number with appropriate direction to meet their desired conditions.

Decisions that identify detailed monitoring requirements for a specific program of forest activities focused on evaluation of the implementation of the Plan and provide a feedback cycle (plan, analyze, implement, and evaluate) of information for planning new projects.

Monitoring and evaluation requirements – Monitoring and evaluating the effects of management practices is required as implementation of the plan progresses.

1.6 Public Involvement

Citizens, tribes, government agencies, and public and private organizations were contacted by mail, e-mail, and through announcements in broadcast and print media throughout the forest plan revision process. This revision began in 1997 when the Need For Change (NFC) was produced and a series of public meetings was held. In 1998, the process halted due to agency and Congressional direction, including budget constraints. Forest planning resumed in 2003, and comments received during the initial planning stage were reviewed. The ANF hired Drs. Susan Sennecah, Gregg Walker, and Steve Daniels to facilitate “collaborative learning” workshops. Public meetings were held through Fall 2003 to discuss the NFC document and the forest planning process.

The Notice of Intent (NOI) was published in the Federal Register on September 23, 2003. Two public meetings were held to discuss the NFC and NOI and 192 comments were received during the public comment period, which ran from September 25, 2003 through November 10, 2003. Two facilitated workshops in 2004 were used to develop draft alternatives, and these initial draft alternatives were discussed at facilitated public meetings in 2005.

In addition to these public meetings, government-to-government meetings were held with various groups, including township supervisors, county commissioners, school district superintendents, Seneca Nation of Indians,

and Commonwealth of Pennsylvania. The comment period for the PLRMP and DEIS ran from May 26, 2006 to August 28, 2006. Eight open house meetings were held to exchange information with interested publics. Two formal hearings to record public comments were held. The first hearing was on August 21, 2006 at Slippery Rock University and the second on August 22, 2006 at the Kane High School. In addition, the ANF met with numerous groups specifically interested in the revision. Appendix A contains a summary of these meetings and the response to public comments. Over 8,000 comments were received.

1.7 Significant Issues

Forest plan revision issues are those areas of forest management that require a change as a result of new scientific information, resource changes, a better understanding of previous management based on monitoring and evaluation information, and/or changing public needs. The issues identified through the planning and public participation process were categorized into two groups, significant issues and other areas of concern, that helped define the scope of the analysis documented in this FEIS.

Significant issues contain a major dispute that necessitates varied approaches in the alternatives. Significant issues may be addressed through management area allocations, resource goals or objectives, acres suited for timber production, allowable sale quantity of timber products, or monitoring requirements.

The other areas of concern identified in the NOI will be addressed through improved standards and guidelines or monitoring strategies in the revised LRMP.

In this section, each issue is described and broken down into major components in the form of questions. Early public involvement validated the issues originally identified in the NOI (see Appendix A, section 2.1.2). Comments received throughout the public involvement process helped focus each issue. Within issues, certain components are more likely to change across alternatives. Those that will change by alternative have specific evaluation criteria that will be used to measure each alternative's response to an issue and to help summarize the effects of each alternative. Components that do not change by alternative are still discussed briefly to carry forward the discussion started in the NOI.

1.7.1 Forest Vegetation Management

This issue involves maintaining healthy forest conditions capable of providing sustainable levels of forest products and amenities. The conditions, estimated at the midpoint of the sixth decade, were selected as a measure to compare long-term effects by alternative. The seven components discussed below will be used to answer the following questions:

- What mix of forest types and vegetation composition are desired?
- What distribution by age classes should be assigned to the desired vegetation structure?
- How will forest health be addressed?
- What will be the mix of silvicultural systems used?

- How will reforestation techniques be modified to meet changing conditions and new information?
- What will be the acreage of forest land suitable for timber production?
- What harvest schedule and mix of forest products should be featured?

Component 1: Vegetation composition

There is considerable disagreement over the mix of forest types for setting desired future conditions in the Forest Plan. Interested publics have expressed a broad range of desired conditions, from expanding high value Allegheny hardwoods, thru maintaining present forest type compositions, to restoring pre-European settlement forest conditions with emphasis on northern hardwoods and hemlock. The most noteworthy item of contention is polarization over black cherry; its abundance now and in the future forest.

The ANF describes plant communities in terms of dominant vegetation, and uses a system of eight forest type groups to describe forest communities: aspen, Allegheny hardwood, upland hardwood, northern hardwood, oak, hemlock, conifer, and open (non-forested land). The Allegheny hardwood type is presently the most valuable timber resource for producing high-quality hardwoods on the ANF, with black cherry being the most valuable species. Upland hardwood and northern hardwood areas with black cherry can be successfully regenerated, and red maple (a primary component in upland hardwoods) is increasing in relative numbers across the forest. The primary species mix in the northern hardwood type (sugar maple, beech, birch, and hemlock) is the most threatened by current insect and disease concerns. In oak stands, understory red maple is replacing more preferred oak species that are valued as a wildlife food source and as high quality hardwoods. Retaining the current level of oak types is a goal under the 1986 Forest Plan. The hemlock and conifer types are valued for wildlife cover and are often more concentrated in riparian areas (hemlock) or in association with oak types (white pine). Guidelines to maintain present levels of hemlock and conifer types exist in the 1986 Forest Plan, but natural regeneration success for hemlock is uncertain and it is threatened by the introduced hemlock woolly adelgid.

Determination of future vegetation composition is constrained by several factors. Forests on the ANF today are predominately mature second-growth that are the result of human and natural events since the late 1800s. Ability to change, perpetuate, or feature different forest types is often limited by present site and overstory conditions. Abundant deer populations in the past have had a lasting effect on our ability to regenerate forest types today. In areas allocated to prescribed forest management practices on the ANF; natural seedling regeneration from existing seed trees has been the preferred method to perpetuate forest cover, but preparation of proper understory conditions has been necessary. Some planting of hardwood and conifer seedlings has been undertaken to supplement natural regeneration and improve diversity.

Forest composition on the ANF is also an important consideration in terms of regional forest management. The current trend on non-industrial private lands in Pennsylvania is often low-investment, high-grade harvesting which results in lower value stands moving toward northern hardwood or upland hardwood species. On industrial private forest lands, management is considered more sustainable, with investments made in reforestation of harvested areas.

Forest types may change due to a number of natural events, such as windthrow, insect and disease infestations, natural succession, mortality from aging trees, and human-caused events such as introduction of exotic forest

insects or disease. The effects of these events on forest health, composition, and structure are much more difficult to control in areas not allocated to prescribed forest management practices. A harvest program focused on shorter-lived forest types, such as Allegheny hardwoods, would best maintain the abundance of these species. The vast majority of these types are rapidly maturing on the ANF and are anticipated to soon start declining in health.

The broad range of desired forest type compositions expressed by interested publics will be evaluated in the alternatives. This will be done through varying the distribution of management areas not allocated to prescribed forest management practices and by varying the forest management practices in the areas that are.

Evaluation criteria

Predicted forest type conversions at the midpoint of the second and sixth decades

Component 2: Vegetation age

The other major element of vegetative diversity is the age of forest vegetation. Almost all of the ANF is currently even-aged second growth, a result of the intensive harvesting that occurred between the 1890s and 1930s (Marquis 1975). The uniform, even-aged second growth forest of the ANF is similar to most of the second growth forest found throughout the region. With regard to age class distribution, the ANF is presently comprised primarily of stands of intermediate ages. The majority of the ANF is older than 80 years (60%), with more than half (57%) of the ANF falls within a thirty year class (the 81-110 age class). Eight percent of the ANF is in the youngest age class (0-20 years old), and approximately four percent is presently older than 110 years. Existing young age classes on the ANF are a result of management activities in the past 20 years, as well as natural disturbances, such as the tornados that impacted nearly 11,000 acres on the ANF in 1985. Remnant old growth areas in excess of 300 years old comprise less than 1 percent of forest vegetation on the ANF.

There is disagreement over how the age of forest vegetation on the ANF should be managed in the revised Land and Resource Management Plan. Some participants in the revision process want more young forest, while others want to increase or retain more older forest. Young forest (0-20 years old) is transitional in nature, and occur from wind, fire, disease, animals, and regeneration harvest activities. Older forest will take time to develop on the ANF, as the bulk of the ANF is presently 81-110 years old. The ANF intends to track this diversity by classifying this continuum in the following major age groups:

- 0-20
- 21-50
- 51-80
- 81-110
- 111-140
- 141-300
- 301+

Ability to achieve a range of age classes is constrained by a number of factors. Harvesting activities directed at creating young forest are limited by patch size (usually under 40 acres) and require a number of sequential

treatments spread over 5 to 20 years to obtain the desired conditions. Natural disturbance patterns inherent to the ANF such as catastrophic wind events can result in sizable areas of blown down trees and interrupt patterns of forest succession, causing instantaneous change from mature forest condition to young forest or non-stocked conditions.

Landscapes consisting of stands of similar sized and aged trees are more vulnerable to damage from a particular pest than if the landscape were composed of stands and forests of a variety of size and age classes (Waring and O'Hara 2005). Variation between alternatives on the level of young and older forest is set to address a range of concerns relating to forest health, forest types, wildlife habitat requirements, and desired harvest outputs.

The amount and spatial arrangement of forest vegetation age classes varies by alternative.

Evaluation criteria

Percent of forested acres by age class at the midpoint of the second and sixth decades

Component 3: Reforestation techniques

ANF personnel have successfully reforested 96% of the acres final harvested (even-aged management) between 1976 and 2001. The majority of these areas have been in the Allegheny hardwood forest type. There is more uncertainty about the reforestation treatments (i.e., type, timing, and sequence) necessary to achieve desired reforestation success, both tree species diversity and tree species abundance, in other forest types (e.g., northern hardwood, upland hardwood, oaks).

Area fencing exclosures to limit deer browsing on desired tree seedlings is an expensive treatment. Project monitoring has confirmed that when interfering plants are removed, fencing is a reliable treatment for obtaining greater vegetative diversity.

Fertilization in Allegheny hardwoods has been effective in obtaining adequate regeneration without fences. In response to new research, future use on plateau sites will be reduced to help maintain soil base cations on certain sites.

Control of undesired interfering vegetation with herbicides remains the only feasible and effective option to prepare understories for seedling development when practicing even-aged or uneven-aged management. Concern over the health risks of herbicides continues. New information has been reviewed and incorporated into updated human health and wildlife risk assessments (see Appendix G).

Increased levels of prescribed burning and mechanical scarification of oak seedbeds will be evaluated to promote oak regeneration on sites where ecologically fire dependant species have developed. Native American use of fire concentrated along the major river corridors is believed to have greatly contributed to the present distribution of oak on the ANF (Brose unpublished, Ruffner and Abrams 2002). New science indicates the shelterwood burn technique would be more effective in maintaining the oak types on the ANF than past methods (Brose *et al.* 1999b).

Release is a relatively new technique applied on the ANF in regenerating stands in order to maintain tree species diversity. The LRMP will evaluate greater use of release treatments to improve tree species diversity in young stands.

No Evaluation Criteria was identified for this component. Past and proposed levels of reforestation treatments are listed by alternative in Table 2-2 Past and Proposed Management Activities.

Component 4: Silvicultural systems used

Some people continue to express strong opposition to even-aged management or, in some cases, to increased use of uneven-aged management on National Forest land. Others strongly support increased use of even-aged management, well above levels achieved on the ANF during recent years, citing a wide array of benefits. Most public opinion falls somewhere between these extremes, just as it did when the 1986 Forest Plan was prepared.

To accomplish vegetative diversity, the ANF will apply three main types of forest management: even-aged, uneven-aged, and no active management. Even-aged management was discussed in the reforestation component.

Uneven-aged management can achieve some resource management objectives better than even-aged systems (e.g., maintaining multi-age, within-stand structure), but there are certain considerations with uneven-aged management. Success rates for uneven-aged management, particularly single-tree selection, have been very low on the ANF in the past, limiting our ability to employ this system. In addition, substantial forest health concerns exist about the use of uneven-aged management, particularly single-tree selection (see three recognized threats under forest health section). New standards and guidelines for the use of uneven-aged management will allow for larger opening sizes, with the intent of regenerating a greater diversity of tree species, including shade-intolerant (e.g., black cherry, yellow poplar, ash, northern red oak) and mid-tolerant (e.g., red maple, birch, cucumber) species than would occur under current standards for uneven-aged management. These new standards and guidelines are anticipated to increase successful regeneration under uneven-aged management, while reducing forest health concerns by promoting a broader array of tree species. Also, adjustments to the uneven-aged management guidelines commensurate with what has been learned since 1986 about their anticipated effects and rates of success will be incorporated in the LRMP. The alternatives will analyze a wide acreage range of silvicultural systems.

Evaluation criteria

- Total acres allocated by dominant silvicultural system based on management area – even-aged, uneven-aged, and no active management
- Estimated total acres regenerated by forest type by silvicultural system predicted by the end of the second and sixth decades

Component 5: Forest health

There is disagreement over the appropriate management responses that should be used to address the range of options for maintaining forest health, and even over what a healthy forest would look like. The ANF has

experienced an unanticipated level of tree mortality and decline since 1985 in all forest types. The following three recognized threats (the first two of which are introduced to the United States) have been a matter of much discussion: the continuing decline and mortality from the beech bark disease complex, the pending advance of the hemlock woolly adelgid infestations occurring east of the ANF, and sugar maple mortality and decline being exacerbated by site nutrient limitations and acid deposition.

There is new information about insect and disease management, exotic species, soil nutrient dynamics, use of prescribed fire, acid deposition, and site/tree species/nutrient suitability. Questions remain about how to establish tree seedlings for the more challenging tree species, the longevity of ANF forest types (particularly the half of the ANF that is 91-110 years old), and potential effects on production of forest products, particularly black cherry.

A primary ecological challenge within the context of forest health and sustainability is the lack of developed forest understories on the ANF, which have been impacted by a legacy of overbrowsing by deer for the past 70 years. This legacy of selective browsing by high deer populations has resulted in understories that are dominated by native invasive species such as ferns, grasses, striped maple, and beech, while desirable seedling regeneration, shrubs, and herbaceous vegetation is greatly reduced in abundance and diversity. At the same time, beech mortality from the introduced beech bark disease complex results in increased beech sprouting which further interferes with establishment and growth of a diversity of tree seedlings. Continuing high levels of acid deposition pose additional stresses for species, such as sugar maple, ash, and basswood that demand higher levels of base cations.

The alternatives will develop a broad range of future vegetative conditions from active and passive management, thereby creating various levels of forest health concerns. Due to the threats listed above, the health of the northern hardwood forest type is of particular concern, which is dominated by a combination of American beech, sugar maple, and eastern hemlock. Another concern is expected from increasing mortality in the Allegheny hardwood type after stands reach 120 years old. Thinning harvests can often improve tree vigor and reduce forest health risks.

Designing treatments to establish tree seedlings (thereby improving forest sustainability) in areas where vegetation management is currently very limited is an option to lower this risk. Appropriate responses to forest health threats on lands not managed for timber production are addressed.

Evaluation criteria

- Acres thinned in decades one and two combined
- Acres of northern hardwood and hemlock forest types at the midpoint of the second and sixth decades
- Acres of Allegheny hardwood forest type $\geq$ 120 years old at the midpoint of the second and sixth decades

Component 6: Acreage of forest land suitable for timber production

The process to determine the area suitable for timber production has three main elements. The first is a need to identify lands permanently in a non-forest condition. The second is an analysis of physical conditions (e.g., rocky, wet, steep) that limit sustainable timber production or reliable tree seedling regeneration. The third involves land

use assignments made to forest areas that emphasize other resource uses that preclude regular scheduled timber harvest.

Under the 1986 Forest Plan, limitations based on physical conditions were underestimated. The forest area taken out of production from oil and gas operations (well pads, pipeline clearings, and roads) since 1986 has also appreciably reduced the area remaining for production of timber. The limitations for physical site conditions and reforestation treatments will not vary by alternative, but has been updated from the 1986 Forest Plan through the use of improved technology and ecological mapping methods.

The latitude to vary the level of forest land suitable for timber production is therefore dependent on the third element in the process where the allocation of management areas are assigned for uses other than timber resources. Under the 1986 Forest Plan, only congressionally-designated areas (i.e., wilderness areas) have been withdrawn. None of these areas have been reconsidered for timber production. Within the design of the alternatives considered, the land assigned as suitable for timber production is balanced with those uses best met without scheduled timber production.

Evaluation criteria

Total acres suitable for sustainable timber production

Component 7: Forest products

A number of commenters believe it is important to continue marketing the valuable forest products the ANF has been producing over the past 20 years of forest plan implementation. Some believe the ANF could do much more and did not achieve product estimates of the 1986 forest plan. Still others believe other amenity values should be emphasized more, with further reductions in forest products from levels achieved over the past 20 years. A sample of such comments shows the full spectrum of views:

“Timber harvest levels are too low. Timber resources need to be utilized and protected now and for future generations.”

“Use best science, information and data to determine [Allowable Sale Quantity] ASQ that is sustainable, given forest health issues.”

“Local communities are too dependent upon timber receipts and need to find alternate ways of achieving economic stability.”

“Recreation is adversely affected by timber management on the ANF. End logging on the ANF.”

The ANF is unique in that it contains nearly 25 percent of the Nation’s total inventory of black cherry sawtimber, which is also in many cases, of better quality than that found on private lands in the region. Demand for hardwoods from the Allegheny Plateau region remains very high as evidenced by the value of hardwoods, which has increased dramatically since 1986. The average real price (i.e., inflation removed) for black cherry and total sawtimber from the ANF has increased more than 400% since 1986. Hardwood values have increased at a greater rate than that predicted in the 1986 Forest Plan. Although harvest estimates fell short of the current forest plan estimates, harvest values nearly matched those projected for the period.

The ANF uses the Spectrum model to determine the most cost-effective mix of silvicultural practices and management prescription allocations to achieve desired conditions for each alternative. Information from the Analysis of Timber Harvest Program Capability Report for 1995-2005 (USDA FS 1995) has been recognized in the harvest level determination. The identified timber volume (i.e., ASQ) and its associated value will vary as an outcome of the alternatives. Plan components related to forest products have been reviewed and adjusted based upon latest knowledge and approach to plan decisions. There are plan components addressing special forest products.

Evaluation criteria

Annual Allowable Sale Quantity (ASQ) for the first and second decades

1.7.2 Habitat Diversity

This issue involves maintaining the viability of native and desired non-native species found on the ANF. The focus of the habitat diversity issue centers on the composition and arrangement of ecological communities present on the landscape. What mix of desired conditions should be featured and what mix of activities and protections will produce the desired outcomes? Five major components for this issue address the following questions:

- What combination of habitats and habitat elements are necessary to sustain the diversity of native and desired non-native species on the ANF?
- What conservation measures are needed to conserve habitat for threatened, endangered, and sensitive species and ensure species viability?
- What guidelines and treatments are needed to effectively control non-native invasive species (NNIS)?
- How can habitat for game species be enhanced, while providing hunting and fishing opportunities and managing populations in balance with the habitat?
- Where, and how much area should be allocated to late structural forests while emphasizing habitat connectivity?

Component 1: Habitat for native and non-native species

Concern over the levels and types of treatments to improve habitat quality and how species will be affected by proposed treatments is at the heart of this issue. Some publics favor active management strategies using a host of prescribed treatments and other publics favor a hands-off approach allowing natural changes to operate. Of primary interest are treatments to promote early and late structural habitats.

More than 300 species of mammals, birds, reptiles, amphibians, and mollusks; more than 70 fish species; more than 1,200 plant species; and more than 1,000 insects are known or believed to occur on the ANF. These species use a variety of habitats and many use very specific habitat features. Updated information on species needs and a landscape analysis of habitat patterns has been completed.

The forest types and structural stages described below form the community types associated with particular plant and wildlife species and were used to evaluate how alternatives provide habitat for these species. To abbreviate the lengthy process of addressing the habitat relationships of every species and potential impacts of forest management activities, a coarse filter approach was used. Five management indicator species (MIS) were selected to represent groups of species that utilize similar habitats and that respond to forest activities in a similar manner.

Forest structure is a combination of the spatial distribution and arrangement of different tree sizes and non-forested areas across the landscape (horizontal structure), and within-stand presence or absence of vegetation layers from the ground to the forest canopy (vertical structure).

With regard to horizontal structure, the ANF is presently comprised primarily of stands in mid-structural stages. There is disagreement over how horizontal structure should be managed in the revised Land and Resource Management Plan. Some participants in the revision process want more early structural stages, while others want to increase or retain more late structural stages. The ANF intends to track this diversity by classifying this continuum in the following major structural stages based on dominant canopy tree sizes: early structural stages (canopy trees 0-5" diameter), mid structural stages (canopy trees 6-20" diameter), late structural stages (canopy trees >21" diameter), and savannahs (areas of < 40 % canopy cover). Vertical diversity is also limited on the ANF, due to the even-aged nature of many stands and the lack of understory diversity due to past browsing by deer.

The amount and spatial arrangement of early and late structural habitat varies by alternative.

Evaluation criteria

See evaluation criteria for habitat diversity components 4 and 5 below. These same measures would reflect how the alternatives provide different levels of habitat for native and non-native species.

Component 2: Habitat for federally-listed threatened, endangered, and sensitive species

Concern for maintaining habitat for rare plants and animals has been expressed in public comments. Some publics believe federal actions are harming potential population recovery, particularly the Indiana bat.

Four Federally-listed threatened or endangered species (T&E) are known to occur on the ANF: bald eagle, Indiana bat, clubshell, and northern riffleshell. Two species of mussel, the sheepnose and the rayed bean, are listed as federal candidate species and are known to occur on the ANF. Habitat for two additional species, the small whorled pogonia and the northeastern bulrush, is present, but no populations have been found on the ANF.

Seventy-eight species with viability concerns have been identified on the ANF. A fine-filter approach is used to analyze important habitat components and to identify potential impacts to each species. A species viability evaluation (SVE) has identified species with viability concerns and conservation practices needed in the forest plan to increase the likelihood that these species will persist on the ANF.

All alternatives provide habitat for viable populations, but to varying degrees.

Evaluation criteria

Species viability outcomes at the midpoint of the sixth decade

Component 3: Non-native invasive species (NNIS)

While many non-native species have proven to be beneficial, it has been clearly demonstrated (US OTA 1993) that other non-native, invasive plant/pest species have caused billions of dollars of damage to the nation's agriculture, environment, and economy.

New management direction has been added for a Non-Native Invasive Species (NNIS) control program. As a result, new standards or guidelines are included on the prevention and control of NNIS that address non-native invasive species of current concern while retaining flexibility to address new non-native species that may be identified in the future. Non-native invasive species management does not vary by alternative.

Component 4: Habitat for game species

The ANF has heard a clear interest from many organizations in maintaining and improving habitat for game species. Partners, such as the National Wild Turkey Federation, Ruffed Grouse Society, Sand County Foundation, and the Kinzua Fish and Wildlife Association, have been major partners in helping the ANF meet wildlife and fish habitat goals. On the other hand some groups would rather de-emphasize direct habitat treatments and let nature take its course. Opinions differ about what forest ages will provide adequate forest habitat for wildlife, particularly species that require early and late structural forest.

Historically high deer populations have impacted habitat for other wildlife species and increased the costs of habitat improvements. Sustaining quality oak habitat, riparian habitat, and quality early and late structural habitat are key ingredients for providing game habitat. Re-establishing oak seedlings to ensure that new oak forests will develop has been difficult and in most cases requires intense management (e.g., prescribed fire, fencing, reduction of low shade). Movement toward a sustainable deer population that is consistent with the ability of the forest to sustain plant and animal diversity has been difficult for some hunters to accept.

Hunting and fishing play an important role in maintaining the diversity and health of the ANF. The Deer Management Assistance Program (DMAP) and other seasons that allow doe harvest are recent tools approved by the Pennsylvania Game Commission (PGC) that are working to lower the deer population. Also, providing sufficient road access for hunting by opening some gates during the fall hunting season is one of the best available management tools. All alternatives will provide habitat to support quality hunting and fishing opportunities.

Evaluation criteria

- Percent of NF lands in three structural stages at the midpoint of the second and sixth decades
 - Early structural habitat (canopy trees 0-5")
 - Mid structural habitat (canopy trees 6-20")
 - Late structural habitat (canopy trees > 21")

- Percent of oak type managed by dominant silvicultural system
 - Even-aged
 - Uneven-aged
 - No active management

Component 5: Old growth/late structural forests and habitat connectivity across the landscape

This issue centers on how much area should be allocated to old growth/late structural forest and how should it be spatially configured on the landscape. Some publics want no more than the current forest plan level and others want substantial increases with emphasis on connectivity, versus scattered isolated areas. The 1986 Forest Plan sets various goals by management area without direction for connectivity.

One option to address connectivity was initiated in 1995 in an informal paper titled, “A Landscape Approach to Providing Late-Successional Forests and Associated Functions and Values on the Allegheny National Forest” (USDA FS 1995). Some projects began to implement this through designating suggested areas as old growth; however, the 1986 Forest Plan was not amended to contain this as a goal.

This concept consists of two elements: core areas and connecting habitat. The core areas are large areas such as wilderness, national recreation areas, scenic areas and remote recreation areas (see MA 7.2, Chapter 2) that permit only natural vegetation disturbances thereby promoting late structural conditions to develop. The core areas would be linked by late structural or older forest habitat. The Species Viability Evaluation identified several benefits of using this configuration for species requiring closed canopy conditions.

For more details on the goals, objectives and management direction to implement this concept see proposed new Management Area 2.2 (applies to linkages, not the core areas) in the LRMP. Briefly, lands within the landscape linkages would remain suitable for timber production but their management emphasizes the sustainability of late structural forests and habitat for species with viability concerns. Stand replacing events (e.g., blowdown) may have salvage activities and reforestation activities to assure future canopy development. Roads not needed for management would be decommissioned and new road construction would be limited.

Remote habitats are areas where human disturbance is minimal. Species that are sensitive to human disturbance survive and reproduce better in these remote habitats. One method for identifying remote habitats across the landscape is to identify large areas without roads.

The amount and configuration of old forest and late structural conditions varies by alternative. Some have more core areas, some feature retaining isolated areas designated by projects under the current plan, and the width and number of linear connectors under proposed MA 2.2 also varies by alternative.

Evaluation criteria

- Percent of NF lands managed for late structural habitat
- Percent of interior and remote habitat remaining at the end of the sixth decade

- High quality remote habitat
- Other remote habitat

1.7.3 Recreation and Special Areas

This issue involves determining the types and amount of recreation opportunities and special areas which will be provided on the ANF. Six components of this issue address the following questions:

- To what extent can the ANF provide developed recreation opportunities and how should they be managed?
- To what extent can dispersed recreation be addressed to improve non-motorized recreation opportunities and clarify direction for managing concentrated dispersed recreation use?
- How should trails be managed for different uses (hiking, ATV/OHM, snowmobile, equestrian, and mountain biking) and in what areas should they be provided?
- What areas determined potentially suitable for wilderness should be recommended as Wilderness Study Areas?
- How should Wild and Scenic Rivers be treated?
- What areas should be considered for other Special Area Management (Research Natural Areas, Scenic Areas, Historic Areas, Experimental Forests)?

Component 1: Developed recreation

Public comment included a desire to provide more developed recreation opportunities spread across the ANF and a motel restaurant complex on the reservoir. Some wanted to see more developments near trailheads in support of ATV/OHM and horse use. Overall, there is agreement for better recreation management and a greater diversity of recreation opportunities.

The 1986 Forest Plan emphasizes opportunities for developed recreation along the Allegheny Reservoir area and along the Allegheny, Tionesta, and Clarion River corridors. Most of the developed recreation was provided along the Allegheny Reservoir where many large-scale recreation areas and campgrounds have been reconstructed and expanded with infrastructure investments completed over the last ten years. In the 1986 Forest Plan, MA 7.0 emphasized direction for these large-scale, high-density recreation developments. There is concern for providing a new emphasis for recreation development that incorporates both large and small scale facilities. Developed recreation opportunities that emphasize large-scale developments continue in MA 7.0 (1986 Forest Plan) or MA 7.1 (LRMP). Developed recreation is constant across alternatives so no evaluation criteria are listed. Adjustments to management direction for MA 7.1 with revised standards and guidelines are included.

A listed goal for developed recreation in the 1986 Forest Plan was for promotion of private capital for construction and operation of a motel/resort complex adjacent to Kinzua Beach. This effort was put on hold in 1989 and remains the most controversial element within the Developed Recreation component. To address concerns for possible motel/resort development along the Allegheny Reservoir, the LRMP contains an objective

for further planning for recreation and other uses in the area surrounding the Reservoir including the National Recreation Area.

Developed recreation opportunities do not vary by alternative.

Component 2: Dispersed recreation

Many comments were received for this component. The ultimate mix of dispersed recreation offered and the predominance of one type of opportunity over another is at issue. The two primary factors to be addressed are improvement of non-motorized recreation opportunities and clarification for managing concentrated dispersed recreation use. Over the last 20 years there has been a reduction in the semi-primitive non-motorized recreation opportunities on the ANF due to increasing road densities (mainly from private oil and gas development). Also, there is no clear direction for managing concentrated dispersed use areas or for constructing ancillary facilities that support the use of these areas. In some cases, it is difficult to distinguish what constitutes a dispersed site as opposed to a developed site.

The need for semi-primitive non-motorized recreation opportunities are addressed by adding the new Management Area 7.2 (remote recreation areas), which is assigned to areas with existing lower density road systems and where disturbances from oil and gas development are not currently anticipated. Varying land allocations for wilderness and remote recreation areas respond to this element of the dispersed recreation issue.

There are no management guidelines for dispersed concentrated use areas throughout the ANF in the 1986 Forest Plan. Many of the sites and trails where dispersed activities are occurring are showing characteristic recreation impacts such as soil compaction, erosion, vegetation trampling, littering, and human waste. Some dispersed sites have been improved to help address resource concerns by providing parking areas, toilets, picnic tables and fire rings. Once development occurred, there was no management direction for transitioning these areas to developed sites or for rehabilitation back to a natural condition. This is addressed by developing a plan objective for concentrated dispersed use areas.

Evaluation criteria

Area of land managed for non-motorized recreation

Component 3: Trails

The alternatives provide a varying amount and distribution of lands available for ATV/OHM and equestrian trail development and use. Dedicated areas are proposed for ATV/OHM and equestrian trail development in order to minimize resource impacts and user conflicts. Hiking and mountain biking do not vary by alternative, except as a result of different management area allocations.

Motorized Trails

There were many comments received in support of expanding motorized trail opportunities. Other comments wanted to limit motorized use due to environmental impacts and disturbance to wildlife. Other concerns with managing motorized trails include: how can the forest plan adequately address allocations or resource capability

in establishing outputs for ATV/OHM trail development and should motorized recreation vehicles such as snowmobiles and ATVs be combined with passenger vehicle traffic on the same roads?

For motorized use of ATV/OHMs, new trail construction is limited to Intensive Use Areas (IUAs) as identified in the 1986 Forest Plan. The 1986 Forest Plan also has an objective for 350 miles of trail designation for ATV and OHM trails; however there are only 108 miles available. While there is a demand for more miles of ATV and/or OHM trails, there is also concern that additional trail mileage for ATV use cannot be achieved in the current Intensive Use Areas due to resource concerns for soils, wildlife and water quality. A combination of new and existing IUAs dedicated to ATV trail development varies by alternative.

The 1986 Forest Plan allowed for development and designation of 350 miles of snowmobile trails. There are currently 366 miles of designated snowmobile trail in which a large portion, (approximately 287 miles), is assigned to roads that allow both snowmobiles and passenger vehicles simultaneously. There is concern for the safety of vehicle operators on these joint use roads. The 366 miles is considered adequate to meet the demand for snowmobile use on the Forest, especially given that the State also provides approximately 2,600 miles of snowmobile trail. There is concern that the snowmobile connector trails may not be adequate to meet public needs. Goals for providing snowmobile connectors are provided in the LRMP. These goals do not vary by alternative.

Equestrian Use

Equestrian use is a popular and growing activity on the ANF, however there are currently no designated trails for this use. Where the 1986 Forest Plan did not address open riding, it has occurred across the forest. Open riding is popular among equestrians, however; the ANF is concerned about long-term unmanaged equestrian use and potential resource impacts this use causes. Soil erosion and sedimentation concerns exist over unmanaged user developed impacts from open riding in some areas. Some users want development of designated trails and others prefer the existing open riding opportunities. Opportunities exist to address a variety of approaches for managing equestrian use. Borrowing from the ATV/OHM management approach of delineating IUAs, Equestrian Use Areas (EUAs) are proposed where equestrian use will be restricted to designated trails. The EUAs are proposed in areas where concentrated use and resource impacts are occurring. Open riding will be allowed on other parts of the forest as an interim. The EUAs along with a combination of riding opportunities vary by management area by alternative.

Evaluation criteria

- Area of land managed for ATV/OHM use (IUAs)
- Area of land managed for equestrian use
 - Equestrian use areas (EUAs)
 - Areas for open riding
 - Restricted areas
 - Prohibited areas

Component 4: Wilderness/roadless areas

The ANF has two wilderness areas totaling nearly 9,000 acres. Some publics want additional areas recommended for designation and others believe current designations are adequate. Some publics also believe national direction for wilderness evaluation is too stringent and that criteria and proposals made by interest groups should be incorporated to promote areas of local interest.

The ANF has completed its updated roadless inventory using current national and regional direction and identified three inventoried roadless areas that have been further evaluated for wilderness study (Tracy Ridge 9,033 acres, Minister Valley – 9,145 acres, and Chestnut Ridge – 5,063 acres) (see Appendix C). Additionally, the Forest Supervisor has added Allegheny Front (6,742 acres) to the alternatives for wilderness evaluation and consideration even though this area is not an inventoried roadless area. The allocation of the four areas as wilderness study areas varies among the alternatives.

Evaluation criteria

Acres recommended for congressionally-designated wilderness study

Component 5: Wild and scenic rivers

Some publics want additional rivers recommended for designation and others believe the current national designations on the Allegheny and Clarion Rivers are adequate. Some publics also expected the Clarion River Management Plan to be a part of forest plan revision.

An assessment was completed to determine changed conditions or new information regarding eligibility status for Wild and Scenic Rivers (see Appendix D). This assessment determined there were no new eligible rivers on the ANF and that Kinzua Creek, determined eligible in the 1982 Nationwide Rivers Inventory, is no longer eligible. New management standards and guidelines to protect current designations for the Allegheny and Clarion Rivers are proposed in Management Area 8.1 and do not vary by alternative. Work on the Clarion River Management Plan will be done under a future amendment to the forest plan.

Component 6: Other special areas

Several groups have submitted proposals for additional special area designations (in addition to potential wilderness or WSR mentioned above); others believe current designations (listed below) are adequate. Many people view special area designations as a way to conserve and protect areas from development, timber harvest and road construction, while others see special area designations as a threat to development opportunities and economic growth.

The 1986 Forest Plan contains the Allegheny National Recreation Area, Tionesta Research Natural Area, Kane Experimental Forest, and Hearts Content and Tionesta Scenic Areas. The ANF also contains portions of the North Country National Scenic Trail and the Longhouse Scenic Byway. The Buckaloons area is identified as a Historic District. The LRMP considers an expansion of Kane Experimental Forest and management of Buckaloons as a special interest area.

1.8 Other Areas of Concern

These include secondary issues that contain some important changes from the 1986 Forest Plan. These elements received additional analysis under Alternatives B through D. However; other than under Alternative A, there is a very limited difference from one alternative to the next. Proposed changes in the following categories make qualitative improvements over the 1986 Forest Plan. No specific evaluation criteria are identified.

1.8.1 Riparian Management

Activities that occur in riparian areas can directly or indirectly affect water quality and riparian-dependant species. Generally, the public agrees on the need to protect water quality. However, some publics have concerns that new riparian corridors and standards and guidelines for riparian area protection reduce the ASQ. The other concern in riparian areas is the need to manage some riparian areas for long-term maintenance of canopy closure to regulate stream temperature and development of large-diameter trees for restoration of stream habitat diversity. Direction for riparian areas is provided through the design criteria section of the LRMP.

1.8.2 Soil Quality

Long term effects from acid deposition on soil productivity and nutrient status are concerns. Soil disturbance and compaction from motorized equipment and dispersed recreation uses are concerns. Updated standards and guidelines address soil erosion, compaction, and productivity. Additionally desired condition, goal and/or objective statements are added to provide direction concerning soil quality.

1.8.3 Scenery Management

Incorporation of new national scenery management guidelines integrates benefits, desires, and preferences for aesthetics and scenery with other resource needs. The updated scenery management system replaces the current visual management system as a scenery planning tool. Mapping and defining of new scenic integrity levels provides direction to achieve desired scenic conditions across the ANF.

1.8.4 Transportation Systems

Concerns were raised on how to plan for and manage road systems on the ANF. This includes road construction, reconstruction, maintenance, and management. Some people want more access and others want existing roads closed and revegetated. Complicating the management of the National Forest System Roads are roughly 1,200 miles of private oil and gas roads resulting in very high road densities in some areas.

The forest plan includes direction on road management for the System Roads and differentiates whether roads will be open, seasonally restricted or closed to the public by management area. The desired mix of forest roads was set at 20 percent open, 20 percent restricted, and 60 percent closed in the 1986 Forest Plan. The LRMP identifies a road system managed for one third each in open, restricted, and closed roads as part of the forestwide desired condition. More roads than anticipated in the 1986 Forest Plan have been managed as open or seasonally open to provide public access, particularly during hunting season. Much of the new construction envisioned in the 1986 Forest Plan, which would have been managed as closed, has not occurred. Whether roads are open or closed

needs to be addressed in concert with access to private ownership lands and ANF resource protection objectives. Access to private lands has been identified as important to landowners.

1.8.5 Monitoring

The convergence of new policy direction, new science, and new public policy expectations are the basis for improvements to the monitoring program in the LRMP. With acknowledgement of limited budgets, cost effective monitoring protocols will be identified in the monitoring implementation guide after the revised Plan is completed. Numerous developments have occurred in the agency's commitment to ecosystem management and adaptive management since 1986. Ecosystem management is defined as an ecological approach to natural resource management to assure productive, healthy ecosystems by blending social, economic, and environmental values. Adaptive management is defined as a type of natural resource management that reflects decision making as an ongoing process. Both concepts rely on monitoring practices to provide the information needed to evaluate progress toward sustainability and to change course in a timely way when that progress is less than satisfactory.

1.8.6 Management Areas

The 1986 Forest Plan outlined 11 different types of management areas that primarily relate to timber outputs and vegetation management, recreation, special areas, wilderness and areas that emphasize managing habitats for wildlife. Each management area has a defined purpose, desired condition, prescriptions and standards and guidelines. Conflicting management goals have been identified in MA 6.2 and 9.1. Other management area boundaries were refined based on changed conditions. New subcategories in MAs 2.0, 5.0, 7.0, and 8.0 were established with new desired future conditions, or previously intended desired conditions that were not being accurately tracked or achieved under the 1986 Forest Plan.

1.8.7 Social and Economic Contributions

The ability of the ANF to contribute to local economies generally centers on the levels of timber, oil and gas, recreation and tourism. These areas have long been key elements in supporting the local economy and tourism is widely viewed as having a greater potential to make an increased contribution. The FEIS analyzes the nature of this contribution by alternative.

1.8.8 Oil and Gas Management

Ninety-three percent of the subsurface mineral rights on the ANF are privately held. In development of subsurface rights, owners need to cooperate with the ANF to protect surface resources. There is already substantial infrastructure associated with the development of these rights and further development is expected. The ANF works with the operators and the Pennsylvania Department of Environmental Protection (DEP) to identify and correct problems.

The FEIS addresses the impacts associated with oil and gas related to specific resource areas. Management Areas have boundaries refined for areas already extensively developed by oil and gas activity. The LRMP includes goals and objectives for acquisition of subsurface rights.

Chapter 2

Alternatives



Photo courtesy of US Forest Service

This page intentionally left blank.

2 ALTERNATIVES

Based on comments on the DEIS, the following changes have been made to Chapter 2:

Developing Alternatives – A summary of changes made to all the alternatives between DEIS and the FEIS is listed. A new Alternative Cm was developed in response to comments on the DEIS. It has replaced Alternative C in the DEIS.

Elements Common to Alternatives – Some corrections to technical information, forest health, and oil and gas development are listed and explained here.

Description of Alternatives – Alternative Cm is described in section 2.4.3.

Description of the Alternatives Considered but Eliminated from Detailed Study – Additional detail has been added in response to comments on the DEIS.

A Comparison of Alternatives – New activity and outcomes numbers were generated for each alternative. Tabular display of ecosystem or other conditions on the land now shows the expected conditions likely to be present at the midpoint of the first, second or sixth decades. These may be referred to as years 2010, 2020 or 2060 in some parts of Chapter II and Chapter III. Display of projected amounts of management activities are generally displayed as the annual average amount expected to occur in the first or second decade of the plan. Some conditions or resources may be described differently.

The following activities were added to Table 2-2:

1. Shelterwood seed cut
2. Pre-commercial thinning
3. Motorized and non-motorized trail construction
4. Dispersed site enhancement in concentrated use areas (CUAs)
5. Construction and reconstruction of developed facilities
6. Wilderness areas managed to standard

2.1 Introduction to the Alternatives

This chapter describes and compares the four management alternatives considered for the land and resource management plan (LRMP) for the ANF. Alternative A, the “no action” alternative, continues the policies and management area (MA) allocations of the 1986 Forest Plan, with some technical adjustments to keep information current and in line with new science. Alternatives B, Cm, and D modify elements of the 1986 Forest Plan in response to identified issues and comments received on the DEIS.

These alternatives provide a framework for analyzing different ways of meeting the purpose and need of the LRMP and for addressing the issues discussed in Chapter 1. These alternatives show a range of options for guiding natural resources management activities on the ANF. Activities are described in terms of the average

annual amount expected to occur by decade or decadal totals. When conditions on the ground are described, they are usually described for the midpoints of the decade. The midpoint of the first decade may be referred to as 2010, the midpoint of the second decade as 2020, and the midpoint of the sixth decade as 2060 to reference these conditions. The alternatives express different desired conditions primarily through different management area allocations. The key purpose of the document is to describe in detail the consequences of implementing any one of the identified alternatives.

2.2 Developing Alternatives

The alternatives include different options to resolve issues and to fulfill the purpose and need discussed in Chapter 1. The public, other federal, state, and local agencies, as well as Forest Service employees, contributed to the identification of three “significant” issues that are addressed with alternatives in the FEIS. Following an interdisciplinary approach, the Forest Service used the three significant issues as the primary basis on which to focus development of four alternatives that are carried forward for detailed analysis in the FEIS. While all four alternatives provide a wide range of multiple uses, goods, and services; each addresses the issues in different ways. See section 2.6.3 for a display of evaluation criteria.

2.2.1 Alternatives Developed and Analyzed in the DEIS

Public participation through collaborative planning workshops held from 2003 into the summer of 2005 helped focus the issues and scope for alternative development. Following these meetings, Forest Service staff finalized four alternatives in response to the issues and need for change.

The DEIS included a “No-Action” alternative (Alternative A) that continued the policies of the 1986 Forest Plan and three action alternatives (Alternatives B, C, and D) that modified elements of the current plan in response to the identified issues. All four alternatives were analyzed with an assumption of full funding and implementation.

2.2.2 Changes to Alternatives between DEIS and FEIS

Comments received on the DEIS led to a number of changes to the alternatives between the DEIS and the FEIS. All alternatives include the following technical changes:

1. There is a net increase in lands tentatively suitable for timber production due to a correction in the acreage withdrawn for roads of 20,140 acres.
2. Conversion of surface lands to oil pads and roads for oil and gas development was built into the analysis (6,660 acres in each of the first four decades).
3. Final harvest of overstories for existing shelterwood stands are scheduled in the first decade except in oaks stands that have already received a shelterwood cut.

As a result of the changes listed above, model results and timber schedules have changed. In the FEIS, activities and outcomes are displayed by decade rather than by planning period. See Table 2-2 for revised activity numbers under all alternatives. Additional technical changes made to model assumptions are described in Appendix B.

MA 5.0 (Wilderness) has been subdivided into two management areas, MA 5.1 for existing wilderness and MA 5.2 for wilderness study areas under all four alternatives.

Alternative C in the DEIS was modified based on public comments and is presented as Cm in the FEIS. Changes to Alternative C include:

1. A net decrease in wilderness study areas (MA 5.2) of 1,717 acres. The Tracey Ridge area (9,033 acres) is now in MA 8.2 (National Recreation Area) and 7,316 acres of the Minister Valley area (east of FR420) is now in MA 5.2.
2. A net decrease of 11,954 acres in Remote Recreation Areas (MA 7.2), based primarily on the reclassification of most of the Minister Valley area as wilderness study area, but also including reclassification of the remaining 1,829 acres of the Minister Valley area as MA 3.0 and reclassification of the Morrison Area as Landscape Corridor (MA2.2). Morrison Valley is no longer considered suitable for remote recreation area due to recent increases in oil and gas development.
3. A net decrease of 14,196 acres in IUA. The proposed Longhouse IUA has been dropped from this alternative.
4. A net decrease of 2,269 acres in late structural linkages (MA 2.2) due to:
 - a. Several locations with oak stands were shifted to MA 3.0 for even-aged management.
 - b. Owls Nest Area MA 1.0 enlarged to reflect current size. It had been reduced in acreage on the east with 1,722 acres having been allocated to MA 2.2.
 - c. Morrison Area changed from MA 7.2 to MA 2.2 as shown above.
 - d. Several locations were added to MA 2.2 from MA 3.0 to provide further protections for the timber rattlesnake.
5. A net increase of 1,848 acres in Late Structural Habitat (MA 6.1) including several visible hillsides along the Allegheny River, previously included in MA 3.0.
6. A net increase of 3,390 acres in MA 3.0 through part of Minister Valley and the addition of certain oak stands previously classified as MA 2.2.

A number of standards and guidelines in the LRMP have been changed to reflect new knowledge and comments received. In particular:

1. One management indicator species (MIS) representing early structural habitat has been added (the mourning warbler).
2. The Allegheny River riparian corridor was increased from 100 to 300 feet.

3. Heavy equipment direction has been added for riparian corridors and wetland management zones
4. Wetlands now have a zone of limited activity of 100 feet and vernal pools have a zone of limited activity of 200 feet
5. Direction has been added for management of surface runoff
6. Directions for oil and gas development has been amended as follows:
 - a. Goals and objectives have been modified with several new additions relating to OGM management
 - b. Acquisition of private mineral rights is one of the new objectives
 - c. Standards and guidelines have been improved
 - d. Direction on USA minerals has been added with stipulations for limited surface occupancy and no surface occupancy
 - e. Several questions related to OGM have been added to the monitoring plan

Changes in standards and guidelines increased the proportion of land deferred from scheduled timber harvest from 10 to 15 percent in alternatives B, Cm and D.

2.3 Elements Common to Alternatives

The four alternatives included for detailed analysis in the FEIS have a number of common elements.

2.3.1 Laws and Regulations

All alternatives were designed to comply with applicable laws and regulations that govern the FS and the management of National Forests. Generally, these laws and regulations are not repeated in the text of this FEIS or in the LRMP.

This LRMP is being developed under the 1982 Forest Planning Rule, as described in Section 1.5.

2.3.2 Technical Information

Each alternative is evaluated with the same set of technical assumptions and data. In developing calculations of acres in different ecological conditions, available for certain uses, or production of different resources, the same sets of criteria are used for all alternatives. This is particularly important in considering Alternative A. Although management direction in the 1986 Forest Plan was based on technical information, some of this information is modified under this FEIS to be consistent with current knowledge. For example, Alternative A is considered with updated information on forest health concerns, lands that are suitable for timber production, methods to develop late-structural conditions, and calculations of ASQ.

2.3.3 Deer Management

All alternatives would have an objective of deer densities on the ANF ranging between 10-20 deer per square mile to restore and maintain a diverse understory habitat condition. The ANF will work with the Pennsylvania Game Commission and use its opportunities under the DMAP program to achieve this deer population objective.

2.3.4 Trail Management

With the exception of opportunities for all-terrain vehicles (ATV), off-highway motorcycles (OHM), and equestrian use, trail opportunities for other uses (e.g. bicycle, cross-country skiing, and hiking) do not vary by alternative except as a result of management area allocation.

2.3.5 Forest Health

Standards and guidelines relative to forest health activities incorporate strategies for dealing with introduced insects and diseases. Activities to support a healthy forest include reforestation practices and treatments to restore vegetative understories and to control the spread of invasive species and integrated pest management (IPM) activities to detect and reduce insect outbreaks, disease, and defoliation.

2.3.6 Oil and Gas Development

Approximately 93 percent of the ANF subsurface mineral rights are owned by private parties. Oil and gas drilling may occur on any part of the forest where subsurface rights are owned by private parties. Table 3-1 displays ANF mineral ownership and status. Of the federally-owned minerals roughly 20 percent are available for development through leasing. Presently, areas of Federal minerals that are withdrawn or not available for leasing are the Allegheny Islands and Hickory Creek Wilderness, Tionesta Research Natural Area (limited to any additional development only), Hearts Content Scenic Area, and the area beneath the Allegheny Reservoir.

The ANF will cooperate in the development of these subsurface rights consistent with maintaining appropriate conservation of ANF surface resources. Alternatives B, Cm, and D will use objectives and design criteria contained in the LRMP to conserve ANF surface resources. An objective has been added in the LRMP to acquire private mineral rights in the following MAs: 5.2, 7.1, 7.2, 8.1, 8.2, 8.3, 8.4, 8.5, and 8.6. Upon acquisition, these areas (except 7.2 and 8.6) would be withdrawn or not available for leasing. MAs 7.2 and 8.6 would not allow surface occupancy for the development of Federal minerals.

2.3.7 Special Designations

All of the areas with special (national) designations under the 1986 Forest Plan continue to be protected under all alternatives. As a result, all of the following specially designated areas are present in all alternatives:

1. Hickory Creek Wilderness and Allegheny Islands Wilderness (MA 5.1)

2. Wild and Scenic River segments of the Allegheny and Clarion Rivers. (Note that Alternative A recognizes the scenic and recreational river segments of the current plan as an overlay to protect the outstandingly remarkable values of these rivers. The other alternatives manage these river segments under a new management area (MA 8.1))
3. Allegheny National Recreation Area (MA 8.2). (Note that Alternative D shows different amounts of MA 8.2 acreage as land within the NRA is allocated to wilderness study areas)
4. Tionesta and Hearts Content Scenic Areas and National Landmarks (MA 8.3)
5. Buckaloons Historic District (MA 8.4) is not proposed as a special designation in Alternative A, but is in all other alternatives.
6. Tionesta Research Natural Area (MA 8.5)
7. Kane Experimental Forest (MA 8.6) (Note that the acreage of the experimental forest is proposed for expansion in all alternatives except Alternative A)
8. North Country National Scenic Trail

Additions to these special designations are described in the appropriate alternatives.

2.4 Description of Alternatives, Including the Proposed Action and No Action

This discussion highlights design features related to key elements of the three issues described in Chapter 1. At the end of this chapter, tables are provided to show management area allocations by alternative (Table 2–1), management activities associated with each alternative (Table 2–2), and a summary of the key evaluation criteria used to compare the alternatives (Table 2–3).

2.4.1 Alternative A: Continuation of the 1986 Forest Plan

Alternative A is a continuation of the management direction contained in 1986 Forest Plan. This constitutes the “No-Action” Alternative for this FEIS. While this alternative continues the management direction of the 1986 Forest Plan, the evaluation of activities, outputs, and environmental effects uses the same technical assumptions as other alternatives, except for the retention of conifer stand overstories in Alternative Cm (see Appendix B for a description of technical assumptions). In this way, Alternative A serves as a baseline for evaluating the effects of continuing the current management of the ANF. Alternatives B, Cm, and D use the management direction in the LRMP. Alternative A responds to the issues identified in Chapter 1 in the following ways:

Vegetation management

The desired condition for vegetation is a mix of predominately younger (0-20 years) and intermediate (21-140 years) forest with an emphasis on retention and regeneration of Allegheny hardwood and oak forest types. The desired condition is accomplished primarily through even-aged management in MAs 1.0 and 3.0. Older forests (>141 years) are provided in disconnected patches across the ANF in MA 6.1, MA 3.0 (where 5 percent of the

land area is dedicated to the retention of old forest), and areas without a scheduled timber harvest (primarily MAs 5.1 and 8.2).

Scheduling of regeneration harvests emphasizes optimal rotations for productivity for each forest type in MA 3.0. Harvest in early decades is primarily from Allegheny hardwood, upland hardwood, and oak forest types. Longer rotations are provided in MA 6.1, 6.2, and older forest areas of MA 3.0. Shorter rotations to emphasize younger forest conditions are provided in MA 1.0. MA 2.1 (2.0 in the 1986 Forest Plan) emphasizes uneven-aged management in three small areas of the forest.

Updated human health and wildlife and aquatic species risk assessments have been completed for herbicide application (Appendix G-1 and G-2, respectively). Glyphosate and/or sulfometuron methyl will continue to be used to help control primarily fern, grass, striped maple, and beech brush using current water protection buffers of 25 to 75 feet.

Habitat diversity

The desired condition is greater habitat diversity through increased provision of early structural (dominant stand layer is less than 5 inches in diameter) and late structural (dominant stand layer is greater than 20 inches) forest conditions. Early structural and mid structural (dominant stand layers are between 5 and 20 inches in diameter) conditions are provided in MA 1.0 and MA 3.0. Late structural conditions are provided in MA 6.1, MA 3.0 (in the 5 percent dedicated to retention of old forest), portions of MA 2.1 (mid to late structural), and other management areas with special designations where no scheduled timber harvest is proposed. This emphasizes a dispersed approach to the location of both early and late structural conditions, although there are concentrations of late-structural habitat (MA 6.1 and MAs 8.1-8.6).

Standards and guidelines in the 1986 Forest Plan as amended provide for the conservation of habitat for threatened, endangered, and sensitive species, as well as for game and non-game species.

Riparian and aquatic species and habitats are conserved through standards and guidelines. Riparian values are the primary objective of forest management projects in riparian areas. Vegetation in these areas will be managed to restore structural and compositional diversity consistent with maintaining riparian values.

Recreation and special areas

MAs 6.1 and 6.2 are intended to provide for some remote non-motorized recreation opportunities. MA 6.2 is configured in four units that emphasize one substantial harvest entry every 40 years followed by a closure of roads to provide opportunities for semi-primitive recreation. Other remote non-motorized recreation opportunities are provided in areas with existing special designations (e.g. wilderness, national recreation area and scenic areas).

Motorized recreation (ATV/OHM) is allowed in five Intensive Use Areas (IUAs) that overlay other management areas. Within these areas ATV/OHM use is restricted to trails established for this use. Recreational ATV/OHM use is not allowed anywhere else on the ANF.

Equestrian trail construction is considered appropriate in MAs 2.1, 3.0, 6.1, 6.2, 8.1, and 7.1. No restrictions or prohibitions are applied to any management area where cross-country riding occurs.

Developed recreation with considerable capital facilities is provided for in MA 7.1 (7.0 in the 1986 Forest Plan) but other opportunities for developed recreation exist in other management areas as well. The plan contains a goal for the development of a lodge-restaurant complex at Kinzua Beach on the Allegheny Reservoir.

The Wild and Scenic Rivers of the forest are managed as an overlay with other management areas. The plan direction requires retention of the outstandingly remarkable values of the rivers with this direction.

2.4.2 Alternative B

Alternative B is designed to respond to the issues identified in Chapter 1 in the following ways:

Vegetation management

The desired condition for vegetation is a mix of predominately younger (0-20 years) and intermediate (21-140 years) forest with an emphasis on retention and regeneration of Allegheny hardwood and oak forest types. The desired condition is accomplished primarily through even-aged management in MAs 1.0 and 3.0. MA 2.2 is managed to provide for large patches of older forest and link them in a connected pattern across the landscape. Areas without scheduled timber harvests (primarily MAs 5.1, 7.2, 7.3, and 8.2) also provide core areas that contribute to this connected landscape pattern.

Scheduling of regeneration harvests emphasizes optimal rotations for productivity for each forest type in MA 3.0. Harvest in early decades is primarily from Allegheny hardwood, upland hardwood, and oak forest types. Longer rotations are provided in MA 6.1. Shorter rotations to emphasize younger forest conditions are provided in MA 1.0. MA 2.2 uses limited harvest activity to maintain continuous forest canopies by even-aged management for oak, conifer, and aspen forest types and uneven-aged management or two-aged management for all other forest types. Other parts of MA 2.2 would not have active vegetation management.

Updated human health and wildlife and aquatic species risk assessments have been completed for herbicide application (Appendix G-1 and G-2, respectively). Glyphosate and/or sulfometuron methyl will continue to be used to help control primarily fern, grass, striped maple, and beech brush using updated LRMP design criteria, including water protection buffers of 25 and 10 feet for mechanical application, and new 10-foot water protection buffers for backpack foliar and cut-stem treatments.

Habitat diversity

The desired condition is greater habitat diversity through increased provision of early structural (dominant stand layer is less than 5 inches in diameter) and late structural (dominant stand layer is greater than 20 inches) forest conditions. This alternative provides for the greatest level of early structural conditions. These are primarily provided by the emphasis on early structural conditions in MA 1.0 and MA 3.0.

Habitat needs for species that use late structural habitat are provided by the spatially contiguous MA 2.2. This emphasizes a connected pattern of late structural conditions across the landscape. MA 2.2, in conjunction with the core areas (specially designated areas and MA 7.2), is also designed to provide remote forest conditions for species that need minimal human disturbance. Previously identified areas of older forest of high ecological value in MA 3.0 are also retained. Standards and guidelines in the LRMP provide for the conservation of habitat for threatened and endangered species and for species with viability concerns.

Riparian and aquatic species and habitats are conserved through standards and guidelines. Riparian values are the primary objectives of forest management projects in riparian areas. Vegetation in these areas will be managed to restore structural and compositional diversity consistent with maintaining riparian values. Special riparian areas (e.g. Wilderness Trout Streams, Class A Trout Streams and Remote Trout Streams) are further protected with additional direction to conserve their values. Special management direction will also be applied to portions of the ANF that drain directly into the Allegheny River (13% Area).

Recreation and special areas

The Clarion River area is managed as a remote recreation area (MA 7.2) providing additional opportunities for remote non-motorized recreation. Part of the Minister Valley area is managed for higher levels of non-motorized dispersed recreation with an emphasis on interpretive opportunities (MA 7.3). Other remote non-motorized recreation opportunities are provided in areas with existing special designations (e.g. wilderness, national recreation area, scenic areas).

Increased opportunities for motorized recreation (ATV/OHM) are provided in five Intensive Use Areas (IUAs) that overlay other management areas. One of these areas (the Longhouse Area east of the Southern part of the Allegheny Reservoir) would be a new IUA replacing the Westline IUA area in the 1986 Forest Plan. Within these areas, ATV/OHM use is restricted to trails established for their use. Recreational ATV/OHM use is not allowed anywhere else on the ANF.

Four equestrian use areas (EUAs) are established to prevent resource damage from existing commercial and heavy recreational use in limited areas. In EUAs, equestrian use will be restricted to designated trails. Outside of EUAs, cross-country riding may occur in all management areas except MAs 5.1, 5.2, 6.3, 7.2, and 7.3, where riding may occur on designated trails only to protect resources. Within MAs 8.3, 8.5, and 8.6, all riding is prohibited.

Developed recreation areas with considerable facilities (development levels 4 and 5) are included in MA 7.1. Other opportunities for developed recreation (of a lesser development level) exist in other management areas as well. The LRMP contains an objective for the completion of a management plan for the land surrounding the Allegheny Reservoir including all of the National Recreation Area around the reservoir. This management plan will identify locations for different types of recreational opportunities and developments including locations of possible lodging or restaurant facilities.

The Wild and Scenic Rivers of the forest are managed with a separate management area (MA 8.1) that focuses management within the Recreation and Scenic River segments on the conservation of their Outstandingly Remarkable Values.

The Kane Experimental Forest (KEF) is expanded to provide increased research opportunities to recognize the different types of forest conditions and forest management issues found on the ANF and the eastern United States. Buckaloons is recommended for designation as a historical area as part of the National Forest system of special interest areas.

2.4.3 Alternative C (modified) (Cm)

Alternative Cm replaces Alternative C from the DEIS. It is designed to respond to the issues in Chapter 1 and comments received on the DEIS.

Vegetation management

The desired condition for vegetation in this alternative is a mix of younger (0-20 years), intermediate (21-140 years), and older (>141 years) forest conditions that emphasizes retention and regeneration of all forest types on the ANF. Younger and intermediate forest conditions are accomplished through even-aged management in MAs 1.0 and 3.0. Older forests are provided in larger areas without scheduled timber harvest (primarily in MAs 5.1, 5.2, 7.2, and 8.2) that are linked with other large patches of older forest in MA 2.2. Older forest is also provided in MA 6.1.

Scheduling of harvest regeneration emphasizes optimal rotations for productivity for each forest type in MA 3.0. Harvest in early decades includes all forest types although harvest of Allegheny hardwood types is the largest share. Alternative Cm provides for an increase in the amount of thinning as compared to Alternative C in the DEIS. Longer rotations are provided in MA 6.1. Shorter rotations to emphasize habitat for species that use younger forest conditions are provided in MA 1.0. MA 2.2 uses limited harvest activity to maintain continuous forest canopies by even-aged management for oak, conifer and aspen forest types and uneven-aged management or two-aged management for all other forest types. Other parts of MA 2.2 would not have active vegetation management.

Updated human health and wildlife and aquatic species risk assessments have been completed for herbicide application (Appendix G-1 and G-2, respectively). Glyphosate and/or sulfometuron methyl will continue to be used to help control primarily fern, grass, striped maple, and beech brush using updated LRMP design criteria, including water protection buffers of 25 and 10 feet for mechanical application, and new 10-foot water protection buffers for backpack foliar and cut-stem treatments.

Habitat diversity

The desired condition is greater habitat diversity through increased provision of early structural (dominant stand layer is less than 5 inches in diameter) and late structural (dominant stand layer is greater than 20 inches in diameter) forest conditions. In this alternative, early structural and mid structural (dominant stand layers are between 6 and 20 inches in diameter) conditions are emphasized in MAs 1.0 and 3.0. Late structural conditions are provided by the spatially-contiguous MA 2.2, MA 2.1 (mid to late structural), MA 6.1, and specially-designated management areas, MAs 5.1 and 5.2.

MA 2.2, in conjunction with the core areas (specially designated areas and MA 7.2), is also designed to provide remote forest conditions for species that need minimal human disturbance. MA 2.2 is both larger and more connected in this alternative than Alternative B to provide a more contiguous forest canopy and increased resiliency to natural disturbance events. Greater retention of late structural conditions in MAs 3.0 and 6.1, and in wilderness and remote recreation areas also provides older forest habitat. Previously identified areas of older forest of high ecological value in MA 3.0 are also retained. Standards and guidelines in the LRMP provide for the conservation of habitat for threatened and endangered species and for species with viability concerns.

Riparian and aquatic species and habitats are conserved through standards and guidelines. Riparian values are the primary objectives of forest management projects in riparian areas. Vegetation in these areas will be managed to restore structural and compositional diversity consistent with maintaining riparian values. Special riparian areas (e.g. Wilderness Trout Streams, Class A Trout Streams and Remote Trout Streams) are further protected with additional direction to conserve their values. Special management direction will also be applied to portions of the ANF that drain directly into the Allegheny River (13% Area).

Recreation and special areas

Clarion River, Hearts Content and East Fork Hickory Creek areas are managed as Remote Recreation Areas (MA 7.2) to provide additional opportunities for remote non-motorized recreation. Other remote non-motorized recreation opportunities are provided in areas with existing special designations and in areas proposed for wilderness study.

Opportunities for motorized recreation (ATV/OHM) are provided in the four IUAs that overlay other management areas. These four areas are smaller versions of the same areas in Alternative B without the Longhouse area. ATV/OHM use is restricted to trails established for their use within the IUAs. Recreational ATV/OHM use is not allowed anywhere else on the ANF.

Four equestrian use areas (EUAs) are established to prevent resource damage from existing commercial and heavy recreational use in limited areas. In EUAs, equestrian use will be restricted to designated trails. Outside of EUAs, cross-country riding may occur in all management areas except MAs 5.1, 5.2, 6.3, 7.2, and 7.3, where riding may occur on designated trails only to protect resources. Within MAs 8.3, 8.5, and 8.6, all riding is prohibited. This alternative differs from Alternative B in terms of allocations for restricted, prohibited, and cross-country riding according to variations in management area allocations.

Developed recreation areas with considerable facilities (development levels 4 and 5) are identified with MA 7.1. Other opportunities for developed recreation (of a lesser development level) exist in other management areas as well. The LRMP contains an objective for the completion of a management plan for the land surrounding the Allegheny Reservoir including all of the National Recreation Area around the reservoir. This management plan will identify locations for different types of recreational opportunities and developments including locations of possible lodging or restaurant facilities.

Minister Valley (7,316 acres east of FR420) and Chestnut Ridge are managed as wilderness study areas (MA 5.2).

The Wild and Scenic River corridors of the ANF are managed with a separate MA (MA 8.1) that focuses management within the recreation and scenic river segments on the conservation of their outstandingly remarkable values.

The KEF is expanded to provide increased research opportunities to recognize the different types of forest conditions and forest management issues found on the ANF and the eastern United States. Buckaloons is recommended for designation as a historical area as part of the National Forest system of special interest areas.

2.4.4 Alternative D

Alternative D is designed to respond to the issues identified in Chapter 1 in the following ways:

Vegetation management

The desired condition for vegetation in this alternative is a mix of predominantly intermediate (21-141 years) and older (>141 years) forest conditions in primarily upland and northern hardwood forest types. Younger (0-20 years) forests are provided through even-aged management primarily in MAs 1.0 and 3.0. Older forests are provided in larger areas without scheduled timber harvest (primarily in MAs 5.1, 5.2, 7.2, and 8.2) that are linked with other large patches of older forest in MA 2.2. Older forest is also provided in MA 6.1. Intermediate forest is provided through even-aged management in MA 3.0 and with uneven-aged management in MA 2.1.

Timber harvest scheduling emphasizes repeated harvest entries in MA 2.1. This uneven-aged management strives to retain continuous forest canopies while providing for regeneration of largely northern and upland forest types. MA 2.2 uses limited harvest activity to maintain continuous forest canopies by even-aged management for oak, conifer and aspen forest types and uneven-aged management or two-aged management for all other forest types. Other parts of MA 2.2 would not have active vegetation management. Based upon estimates of the proportion of younger forest conditions present in pre-settlement conditions, even-aged harvests are scheduled in MAs 1.0, 3.0, 6.1 and in oak types of MA 2.2.

Updated human health and wildlife and aquatic species risk assessments have been completed (Appendix G-1 and G-2, respectively). Glyphosate and/or sulfometuron methyl will continue to be used to help control primarily fern, grass, striped maple, and beech brush using updated LRMP design criteria, including water protection buffers of 25 and 10 feet for mechanical application, and new 10-foot water protection buffers for backpack foliar and cut-stem treatments.

Habitat diversity

The desired condition is greater habitat diversity through increased provision of late structural (dominant stand layer is greater than 20 inches in diameter) forest conditions. Early structural (dominant stand layer is less than 5 inches in diameter) and mid structural (dominant stand layers are between 5 and 20 inches in diameter) are provided in MA 1.0 and MA 3.0. This alternative places an emphasis on late structural habitat and continuous forest cover in MA 2.1 and MA 2.2, and would provide for the largest amount of late structural habitat.

MA 2.2, in conjunction with the core areas (specially designated areas and MA 7.2), is also designed to provide remote forest conditions for species that need minimal human disturbance. This alternative provides the largest acreage of land area in MA 2.2 to provide a more contiguous forest canopy and increased resiliency to natural disturbance events. Greater retention of older forests in MA 3.0, MA 6.1 and in wilderness and remote recreation areas also provides for late structural habitat. Early structural habitat has less emphasis and is provided in MAs 1.0 and 3.0. Previously identified areas of older forest of high ecological value in MA 3.0 are also retained. Standards and guidelines in the LRMP provide for the conservation of habitat for threatened and endangered species and for species with viability concerns.

Riparian and aquatic species and habitats are conserved through standards and guidelines. Riparian values are the primary objectives of forest management projects in riparian areas. Vegetation in these areas will be managed to restore structural and compositional diversity consistent with maintaining riparian values. Special riparian areas (e.g. Wilderness Trout Streams, Class A Trout Streams and Remote Trout Streams) are further protected with additional direction to conserve their values. Special management direction will also be applied to portions of the ANF that drain directly into the Allegheny River (13% Area).

Recreation and special areas

Clarion River, Morrison, South Cornplanter, Longhouse, Hearts Content, East Fork Hickory Creek, and Lamentation areas are managed as remote recreation areas (MA 7.2) to provide additional opportunities for remote non-motorized recreation. Other remote non-motorized recreation opportunities are provided in areas with existing special designations and in areas proposed for wilderness study.

Opportunities for motorized recreation (ATV/OHM) are provided in three IUAs that overlay other management areas. This alternative provides less land area in IUAs than the 1986 Forest Plan in order to minimize ATV/OHM effects. Within these areas, ATV/OHM use is restricted to trails established for this use. Recreational ATV/OHM use is not allowed anywhere else on the ANF.

Equestrian use is allocated to three large EUAs in which riding is restricted to designated trails only. Outside of EUAs, all riding, either cross-country or on designated trails, is prohibited.

Developed recreation areas with considerable facilities (development levels 4 and 5) are provided in MA 7.1. Other opportunities for developed recreation (of a lesser development level) exist in other management areas as well. The LRMP contains an objective for the completion of a management plan for the land surrounding the Allegheny Reservoir including all of the National Recreation Areas around the Reservoir. This management plan will identify locations for different types of recreational opportunities and developments including locations of possible lodging or restaurant facilities.

Tracy Ridge, Chestnut Ridge, Minister Valley, and Allegheny Front areas are managed as wilderness study areas (MA 5.2); the largest amount of any alternative.

The Wild and Scenic River corridors of the ANF are managed with a separate MA (MA 8.1) that focuses management within the recreation and scenic river segments on the conservation of their outstandingly remarkable values.

The KEF is expanded to provide increased research opportunities to recognize the different types of forest conditions and forest management issues found on the ANF and the Eastern United States. Buckaloons is recommended for designation as a historical area as part of the National Forest system of special interest areas.

2.5 Description of Alternatives Considered but Eliminated from Detailed Study

The ANF received a variety of proposals for consideration during development of alternatives. These proposals included both full alternatives and specific design elements, and came from citizen and local government groups, and individuals. Many of the elements presented were considered during the planning process. For example, all of the areas recommended for wilderness were considered through the roadless area inventory and possible wilderness study areas were identified and evaluated. The following discussion summarizes these proposals and why, after consideration, they were eliminated as a whole from detailed study. Various components are addressed by the issues and alternatives identified in Chapters 1 and 2. Appendix A displays public involvement in more detail.

2.5.1 Allegheny Wild! by the Allegheny Defense Project (ADP)

The Allegheny Defense Project (ADP) submitted a report containing 84 resolutions relating (broadly) to resource extraction, wilderness and special area management, biological diversity and ecological health, recreation, and the forest planning and appeals process. The following discussion summarizes each of these resolutions (and, for the purposes of this description, combines some of the resolutions (e.g. biodiversity concerns)), and then for each describes how the ANF considered ADP's concerns:

1. The FS should end commercial logging on the ANF.
2. A new approach to oil and gas development, including phasing out new drilling over the next 30 years, and restoring degraded landscapes
3. Adoption of 45,000 acres of new wilderness
4. Designation of new National Recreation Areas, Research Natural Areas, Scenic Areas, Historic Areas, and Recreation Areas
5. A redistribution of management areas to reflect management for multiple use, including watershed protection, soils conservation, conservation of rare species, Wilderness and forest restoration, including management area designations for federally-designated and special features (e.g. Wild and Scenic River corridors, National Scenic Trail corridors, remote trout streams, wilderness study areas, roadless areas, old growth).
6. Reduce road mileage on the ANF by 1,000 miles over the next 10 years and incorporate roads into a roads-to-trail program
7. Stop promoting growth of black cherry. Set DFCs to restoration of northern hardwood and other native forest types

8. Incorporate standards and guidelines, goals and objectives for state threatened and endangered species, as well as federally-listed sensitive species
9. Draft the forest plan in a way that allows for ease of amendment (specifically, ADP mentions incorporating the ANF's 1995 old-growth plan, not modifying sensitive species lists through administrative changes)
10. Implement the 1995 Landscape Corridor Plan
11. Specify timing, methods, and evaluation protocol for management activities must be spelled out with specificity in the forest plan.
12. Reassess management strategies for effects on biodiversity, including:
 - a. Reverse the progression towards black cherry-dominated stands. Allow for mid- and late-successional stages of development in northern hardwood-hemlock stands.
 - b. Control white-tailed deer populations to promote herbaceous species diversity
 - c. Control the effects of white-tailed deer populations through predator and habitat relationships
 - d. Update the FS sensitive species list to include all fish species that are state listed, and all extirpated species that survive in nearby watersheds; manage bluebreast darter habitat
 - e. Maintain diversity of aquatic invertebrates
 - f. Protect amphibian and reptile populations and habitat (includes identifying amphibian and reptile management indicator species and increasing research and monitoring)
 - g. Complete forest-wide surveys for terrestrial invertebrates
 - h. Complete forest-wide surveys for lichen, moss, and fungi
 - i. Adopt landscape corridor to promote avian habitat and revise MIS list to focus on restoring native avian species at their historical levels; Protect nesting habitat of sensitive and threatened species
 - j. encourage native distribution of mammal species wherever possible
13. Reassess management strategies for effects on forest habitat structure, including:
 - a. Encourage recruitment of mid-story species and mid- to late-successional stands
 - b. Leave forests alone to recruit standing dead trees
 - c. Emphasize down woody debris throughout the ANF (esp. in MAs 3.0 and 6.2)
 - d. Allow natural succession to take its course on the ANF

14. Reassess management strategies for controlling invasive species, including:
 - a. ensuring genetically-resistant American beech are never cut down or removed
 - b. reversing trends towards Allegheny hardwood stands in order to decrease potential for damage by “cherry scallop” moth
 - c. Expand methods to prevent introduction of zebra mussel
15. Reassess management strategies for air pollution, including:
 - a. decreasing emphasis on black cherry, since black cherry is sensitive to ground level ozone, and developing standards and guidelines for “problems that originate in other jurisdictions”
 - b. Incorporating an acid deposition management plan, including methods to preserve soil nutrition
 - c. Taking a proactive approach towards issues involving air quality (e.g. taking an interest in planned expansion at United Refinery)
16. Reassess management strategies for soils conservation, including:
 - a. Retaining biomass and standing trees, decommissioning roads in areas of forest decline and resisting introduction of new pollutants
 - b. replacing commercial nitrogen-rich fertilizers, discouraging use of fertilizers for black cherry regeneration
 - c. Adopting more stringent limitations on soil disturbance; limiting multi-entry restoration work; and regulating equipment used in forest restoration work
17. Reassess management strategies for threatened and endangered species management, including:
 - a. developing old growth and wilderness habitat for Indiana bat
 - b. Adopting standards and guidelines for Northern riffleshell and clubshell mussels and their habitats (including guidelines for managing Tionesta Creek)
 - c. Adopting conservation recommendations for bald eagle as standards and guidelines
 - d. Restore forest understories to support recovery of small whorled pogonia
 - e. Identify cerulean warbler habitats on the ANF and begin standards and guidelines consistent with requirements of ESA

18. Reassess management strategies for recreation management, including:
 - a. Issuing a moratorium on new ATV trails on the ANF
 - b. Controlling illegal off-road vehicle use
 - c. Adopting standards and guidelines to phase in mandatory conversion to four-stroke machines for snowmobilers on the ANF and enhancing scenic quality of trail routes
19. Reassess management strategies for watershed management, including:
 - a. Adopting a management plan for water quality in the upper Allegheny; recognizing high quality waters, exceptional value streams and wilderness trout streams through management areas
 - b. Lower road densities of FS roads; discourage new construction; and ensure high-quality road surfacing
 - c. Ending commercial logging to reduce potential future runoff; restoring already logged sites
 - d. Eliminate use of herbicides in forestry practices
 - e. Ending clearcutting and herbicide use to protect municipal watersheds
 - f. Prohibiting the use of pesticides in riparian areas
20. Reassess management strategies for oil and gas development, including:
 - a. Phasing out future oil and gas development
 - b. Surveying and monitoring all oil and gas facilities on the ANF and participating in permitting and pollution control
 - c. Actively enforcing special use permitting for rights-of-way
 - d. Implementing a plan to acquire all subsurface mineral rights on the ANF
 - e. Ending all support for oil and gas drilling on the ANF
21. Reassess management strategies for wildlife management, including:
 - a. Developing a representative list of management indicator species
 - b. Developing science-based protocol for monitoring wildlife population trends

22. Reassess Wild and Scenic River management, including:
 - a. Increasing protection and proactive management of Allegheny River
 - b. Developing a Wild and Scenic River Management Plan for Clarion River
 - c. Developing management plans for Bear Creek, Tionesta Creek, East Branch Tionesta, Kinzua Creek, Salmon Creek, Spring Creek, Sugar Run, and Big Mill Creek. (including consideration for designation under Wild and Scenic Rivers Act)
23. Purchase significant cave sites adjacent to FS lands and adopt a cave management plan on the ANF. Survey and monitor known caves for winter use
24. Remove commercial logging or establish a “reasonable” ASQ
25. Identify and adopt specially-designated historic areas
26. Incorporate opportunities for research into standards, guidelines, and management area direction and adopt new Research Natural Areas.
27. Provide a better distribution of trails, campsites, and feature recreation areas throughout the Allegheny.
28. Designate new scenic areas and purchase mineral rights beneath Tionesta Scenic Area
29. Replace commercial logging program with restoration-based program that emphasizes wildlife conservation and low-impact recreation and tourism
30. Initiate forest restoration activities that lead to job creation
31. Urge townships to accept guaranteed payment method
32. Increase outreach for low-impact recreation activities. Halt all logging around areas of recreational value. Pursue mineral rights in these same areas. Provide interpretive stops for travelers. Develop more hiking trails.
33. Emphasize ecosystem services
34. End commercial logging to increase market value for timber on private lands
35. Promote community investment
36. Increase environmental education opportunities
37. Increase quality disability experiences
38. Institute public health and safety program

The following discusses each of the previous points. For each point, a brief description is provided as to how the ANF considered the point in developing the plan. The description may identify how the point is incorporated in the forest plan (LRMP), the alternatives, the FEIS or why the point was not specifically considered either in preparing a full alternative or a portion of an alternative.

1. Since the Organic Administration Act of 1897, which allowed for the establishment of forest reserves, timber production has been an established purpose of National Forest management. This purpose is confirmed and repeated in the various laws and regulations that direct FS management, including the 1960 Multiple Use Sustained Yield Act (MUSYA), and the 1976 National Forest Management Act (NFMA).

The ANF is not evaluating a total prohibition of a legally-established use and/or purpose of National Forests. Eliminating timber harvesting on the ANF does not meet the purpose and need of this plan revision that includes the provision of a diversity of vegetative habitats, including the provision of early structural forest conditions. The use of commercial logging is an important tool in achieving these habitats. Commercial logging is also an important tool to address forest health concerns. However, the amounts and levels of commercial logging are varied in the alternatives in response to different approaches to the major issues. Alternative D was specifically designed to provide for vegetative structural conditions that would result from historic levels of natural disturbances. Timber harvesting is a tool to accomplish this. A minimum benchmark that does not harvest timber was also considered (see Appendix B).

2. The ANF does not own mineral rights on 93 percent of its land base and is not evaluating prohibition of a legally-established use on the forest. Further oil and gas development is an action of private parties. Unless the ANF acquires the entirety of subsurface rights, consideration of an alternative that assumed the ANF could stop such legal development would be outside of the legal authority of the ANF. The LRMP contains objectives for acquisition of subsurface rights, especially where acquisition can contribute to the recreation and special areas issue of the purpose and need for revision. Effects of mineral resources development are considered under cumulative effects on each resource analyzed in Chapter 3 of the FEIS.

Rehabilitation of sites damaged by oil and gas development does occur and the LRMP contains standards and guidelines that address expectations for development of the ANF subsurface that is consistent with surface objectives.

3. The ANF conducted a roadless inventory and wilderness evaluation as part of the revision process. Of the areas recommended by ADP, Tracy Ridge, Chestnut Ridge, Minister Valley, and Allegheny Front are considered for wilderness designation in Alternative D. Other areas recommended by ADP for wilderness did not meet the criteria for wilderness (see Appendix C). The ANF considered other management options for the conservation of natural areas identified by ADP for wilderness. This includes remote recreation areas for the Clarion River, Morrison, and Hickory Creek areas in Alternative D. The Tionesta area surrounding the existing Scenic and Research Natural Areas was not considered for special area designation due to the level of current roading and oil and gas development in this area.

4. The ANF specifically considered all of the areas recommended by ADP. In most cases, the areas recommended did not contain the outstanding values necessary for designation, but many contained attributes that place them in management areas that emphasize wildlife habitat, recreation, scenic, and historic values.

ADP proposed new National Recreation Areas (NRAs): Tionesta, Lamentation Run, and Bear Creek. At present, there are 23 NRAs in 19 states. The Allegheny contains one of four NRAs in Region 9 of the Forest Service (an area extending from New Hampshire to Missouri). The Allegheny NRA possesses regional outstanding values for hiking, remote recreation, and scenery. Of the areas proposed by ADP, all have been roaded and have oil and gas activity. These areas (with the possible exception of the Tionesta Scenic and Research Natural Areas already established) do not possess significant or exceptional features that would merit national designation. Tionesta and Bear Creek contain too many roads and oil and gas developments to merit consideration for remote recreation areas (MA 7.2) and Lamentation Run is included as a remote recreation area in Alternative D.

ADP proposed the Muzette tract for inclusion as a Research Natural Area (RNA). At present the ANF contains one RNA at Tionesta that represents the Laurentian Mixed Forest Province. Due to the extensive development of the ANF, it is difficult to find other representative areas for RNAs. Four candidate Research Natural Areas (RNAs) were proposed in the 1986 Forest Plan: the Muzette Tract, Crull's Island, Thompson Island, and Sheffield Compartment 126. After review, Muzette was dropped from consideration because it was not unique and it was too small to manage for research purposes. The remaining three were recommended for designation as RNAs by the regional office. In 1990, the Washington Office of the FS decided against designation. The basis for their decision was that the future potential heavy use by dispersed recreationists would not make them suitable for RNAs. Given that decision, the ANF has elected not to reconsider this option as part of this revision.

ADP proposed a scenic area at Bogus Rocks. While the area contains natural beauty and attractive scenery, it does not contain outstanding characteristics meriting national designation. The area is also small (<100 acres), and most scenic areas are considerably larger than 100 acres.

ADP proposed the Colisomo Rockshelter and the Little Drummer Historical Pathways be designated as historic areas. Rock shelters have been known to have potential for having been used by prehistoric Native Americans, but the Colisomo Rockshelter yielded no prehistoric or historic artifacts. The area does not meet the criteria for inclusion in the National Register of Historic Places. The "Little Drummer" is a synonym for grouse and this pathway was constructed as a wildlife viewing area. While located on a railroad grade, the grade does not retain any integrity of construction, design, and setting to be considered historically significant for inclusion in the National Register of Historic Places. For these reasons, these areas are not proposed as historic areas. Alternatives B, Cm, and D all contain a recommendation to designate Buckaloons as a historic area.

ADP also proposed 12 areas as Recreation Areas. Of these areas, three (Buckaloons, Twin Lakes, and Loleta) are managed as developed recreation areas (MA 7.1) in the alternatives. The other nine all contain

recreation attributes common to the Allegheny. Standards and guidelines in the revised plan provide direction for maintaining the recreation and scenic quality of these areas.

5. Management Areas are only one way to organize plan direction to provide for the different multiple uses of the forest. There is no need to specifically identify management areas for each use. Standards and guidelines of the plan specifically address watershed protection, soil conservation, conservation of species, the North Country Trail, remote trout streams and conservation of older forests. The ANF has management areas for Wild and Scenic River corridors (MA 8.1), Wilderness and Wilderness Study Areas (MAs 5.1 and 5.2), areas to promote late structural forest conditions (MAs 2.2 and 6.1) and non-motorized recreation (MA7.2).
6. Reducing the level of roads is not part of the purpose and need for this revision. However, the ANF has examined in the various alternatives establishing larger areas of the forest without roads, including nearly all of the specific areas recommended by the public for management without roads. The plan includes objectives for decommissioning roads. The ANF also faces limitations in considering decommissioning of state and township roads and OGM roads without the OGM operator's or local government's permission. Determining what roads are needed to meet management needs is primarily a project decision made through roads analysis at the project scale. For these reasons, the ANF has elected not to specifically examine an alternative focused specifically on a targeted level of road reduction.
7. The four alternatives explicitly vary the emphasis on various forest types. Alternative B emphasizes forest types containing black cherry and Alternative D emphasizes northern hardwood forest types.
8. Changes were made to the Regional Forester Sensitive Species list based on ANF proposals. The list contains all state-listed threatened and endangered species present on the ANF. The LRMP provides standards and guidelines for creation, enhancement, and protection of quality early and late structural, and riparian habitat. There are also specific standards and guidelines for species with viability concerns.
9. The forest plan has been reformatted during for this revision. By more clearly labeling the forest plan decisions, it should be easier to more clearly interpret the plan and to clarify when amendment is needed.
10. Varying acreage of older forest/landscape linkages developed from the 1995 landscape corridor plan is included as MA 2.2 in Alternatives B, Cm, and D. Isolated stands for future late structural forest are also considered in each alternative.
11. The LRMP contains a summary of a monitoring strategy that includes key monitoring questions to be evaluated during plan implementation. Detailed information on monitoring protocols will be developed in a separate monitoring guide.
12. Diversity of species (plant and animal) and habitat is a key element of the LRMPS desired future condition with goals and objectives for ANF management.
 - a. Alternative D emphasizes northern hardwood stands.

- b. The LRMP (Alternatives B, Cm, and D) contains an objective to maintain a deer population of 10-20 deer/square mile. White-tailed deer habitat relationships are a consideration in vegetation management decisions.
 - c. The ANF has not specifically considered any alternative to reintroduce predators to control white tailed deer. It will cooperate with USFWS and Pennsylvania Game Commission in considering any potential actions of this type.
 - d. The Regional Forester's Sensitive Species list has been updated to include state-listed fish species that occur on the ANF.
 - e. Standards and guidelines for protection of aquatic invertebrates are included in the LRMP. These include protections for vernal pools, springs, and seeps.
 - f. Standards and guidelines for management of components of amphibian and reptile habitat (e.g. down woody debris, snags, riparian zones) and MIS are included in the LRMP.
 - g. Comprehensive surveys for terrestrial invertebrates would be prohibitively expensive and thus infeasible. The determination of the need for surveys will be made either at the project level or as part of the monitoring protocols.
 - h. Comprehensive surveys for lichens, moss, fungi would be prohibitively expensive and thus infeasible. The determination of the need for surveys will be made either at the project level or as part of the monitoring protocols.
 - i. The landscape corridor concept is provided for in Alternatives B, Cm, and D. Northern goshawk, cerulean warbler and mourning warbler are identified as Management Indicator Species (MIS). Given the enormous amount of change that has occurred in this region, it would not be possible to restore avian species to historical levels. Sensitive avian species were considered in the Species Viability Evaluation (see Appendix E).
 - j. The LRMP contains direction to protect the habitat and populations of those mammal species at greatest risk. In addition to major provisions for habitat contained in the alternatives, standards and guidelines are present to conserve populations of these species.
13. The LRMP specifically addresses stand structure issues, including:
- a. Increasing mid-story recruitment and late structural stands in all management areas, with specific objectives, standards and guidelines for those that allow timber harvest.
 - b. Standards and guidelines for retaining snags.
 - c. Standards and guidelines for down woody debris.

- d. Opportunities for natural succession are provided in certain areas of the forest (e.g. MA 5.1, 5.2, and 7.2) depending on the alternative. Alternative D focuses on creating the mix of forest conditions in terms of structural stages that are estimated to have been present historically on the forest. It contains a component of active management to achieve this.

14. The LRMP and FEIS considered strategies for a variety of invasive species:

- a. The LRMP promotes conservation of disease-resistant beech.
- b. Alternative D emphasizes restoration of northern hardwood forests rather than Allegheny hardwoods.
- c. Objectives, standards and guidelines for zebra mussel control are provided in the LRMP.

15. The LRMP and FEIS considered strategies to address problems of air pollution. These include:

- a. The FS monitors ozone damage nationally, including sites on the ANF. The alternatives vary their emphasis on the extent of Allegheny hardwood forest. All alternatives emphasize sustaining a diversity of forest types, structural classes, and healthy ecosystems across the ANF. Black cherry is not considered to be disproportionately affected by ozone on the ANF. Impacts to ozone indicator plants such as black cherry on the ANF were small as compared to studies in other areas (Morin et al., 2006). These local studies also indicate that ozone has not substantially damaged woody vegetation on the ANF.
- b. Research efforts have been completed with information on the status of soils and vegetation on the ANF. The severity of acid deposition threat is described in the FEIS. The LRMP contains standards and guidelines to preserve soil nutrition. Methods of restoring soil nutrition, such as liming, are not precluded by the LRMP.
- c. The ANF plan does not include actions to control the impacts of others outside of the forest plan boundary. Although this is beyond the scope of the plan, the ANF LRMP has a goal to cooperate with regulatory agencies to reduce adverse effects of air pollution.

16. The LRMP provides goals, objectives, standards, and guidelines for water and soil management which include:

- a. Retaining down woody material, etc. and limitations to road and facilities development in riparian areas.
- b. Restrictions on the use of nitrogen- and phosphorus-based fertilizers and avoidance of broadcast application of nitrogen-based fertilizers on plateau, shoulder and upper backslope landforms to help maintain soil base cation status.
- c. Standards and guidelines or references to other directives to minimize compaction and erosion, and special attention for riparian-dependent resources in riparian areas, including establishment of

a minimum 200-ft riparian zone around Wilderness Trout Streams, Remote Trout Streams, and Class A Wild Trout Stream.

17. The LRMP provides specific standards and guidelines for management of Indiana bat, Northern riffleshell and clubshell mussels, bald eagle, small-whorled pogonia, and cerulean warbler, as well as standards and guidelines for management of other species.
18. A range of recreational opportunities are considered in the FEIS.
 - a. ATV/OHM use is recognized as a legitimate recreational use of the ANF. Standards and guidelines of the LRMP only allow ATV/OHM use on designated routes and trails in designated areas. Alternative D considers the effects of a reduction of the land area available for ATV/OHM development.
 - b. The ANF does not condone illegal ATV/OHM use on the forest and actively enforces compliance.
 - c. The ANF has elected not to specifically examine establishing specific standards and guidelines related to the design or operation of snowmobiles as part of this plan. As the industry phases in machines that have four stroke engines, these would also be used on the ANF.
19. All of the alternatives provide standards and guidelines that provide special attention to riparian values for forest management projects in riparian areas. Vegetation in these areas will be managed to restore structural and compositional diversity consistent with maintaining riparian values.
 - a. The LRMP provides standards and guidelines for all streams including high quality streams, exceptional value streams, Wilderness Trout Streams, Class A trout streams, and remote trout streams, as well as other water resources
 - b. Variations in road levels by alternative are discussed in the FEIS. Standards and guidelines for road maintenance and construction, including roads in riparian corridors, are included in the LRMP.
 - c. Commercial logging is addressed in response #1.
 - d. The ANF considers herbicide to be an important tool for vegetation management. Herbicide application is decided at the project level. The LRMP contains a substantial set of standards and guidelines to ensure that application of herbicides are implemented in a safe manner. Appendix G of the FEIS specifically examines the effects of herbicide application on the ANF.
 - e. The ANF considered but rejected the need to prohibit logging or herbicide use within municipal watersheds. There is no discernible risk to human health related to water quality from either logging or herbicide application consistent with LRMP standards and guidelines.

- f. Vegetation management, including herbicide use, is restricted with specific standards and guidelines in riparian corridors
- 20. The ANF does not own the mineral rights on 93 percent of its land base. It would not be feasible to consider a prohibition of this legally-established use across the forest. Since mineral development is an established use on national forest lands, the LRMP does not consider an alternative to acquire all oil and gas subsurface rights. Acquisition of all of these rights would be very costly and thus infeasible. Consistent with the purpose and need of the plan, the LRMP does contain objectives to acquire oil and gas subsurface rights to conserve special areas. It also contains a substantial section of standards and guidelines to manage surface disturbance associated with oil and gas development. The monitoring part of the plan contains questions related to the monitoring of oil and gas developments.
- 21. The LRMP contains goals, objectives, standards and guidelines for wildlife management. Five management indicator species (MIS) are identified in the FEIS: Northern goshawk, cerulean warbler, timber rattlesnake, mourning warbler, and aquatic invertebrates. Specific elements of the monitoring strategy will identify protocols regarding MIS.
- 22. Alternatives B, Cm, and D provide for management of Wild and Scenic River corridors under a separate management area and protection of special riparian areas through updated standards and guidelines to conserve their values. As a general rule, alternatives do not contain elements focused on developing future plans. The ANF intends to develop a Clarion River Management Plan.

As part of the forest plan revision process, 13 waterways were evaluated for eligibility for Wild and Scenic River designation (Appendix D). The eligibility process resulted in finding no rivers or river segments eligible for inclusion in the National Wild and Scenic Rivers system.

- 23. The LRMP does not add specific provisions for caves as the ANF manages caves consistent with provisions of the Cave Resources Protection Act (PL 100-691) of 1988.
- 24. See response #1. Each alternative identifies an appropriate ASQ relative to its design. ASQ is a ceiling on timber harvest and is not an objective of the plan.
- 25. See response #4.
- 26. See response #4 Research opportunities and limitations are described in the LRMP.
- 27. Decisions about the locations of new recreational facilities such as campgrounds, trails, trailheads and other facilities are a project determination. The LRMP envisions greater amounts of trails for horse use, bicycle use, and other recreational developments throughout the ANF consistent with the management direction for the area.
- 28. See response #4. The LRMP contains objectives to acquire the subsurface rights under the Tionesta Scenic Area.

29. The ANF envisions a variety of activities that are part of management to move the forest towards the desired condition of the LRMP. These activities include a substantial set of activities, including commercial logging (see #1), designed to restore forest conditions. Alternative D provides the most opportunity for low-impact recreation activities.
30. Job impacts associated with restoration activities of the plan are part of the federal expenditures identified in Chapter 3 and Appendix B of the FEIS.
31. The choice of whether local governments chose payments under the 25 Percent Fund or Secure Rural Schools is outside the scope of the plan. The financial implications of the alternatives relative to either choice are described in the Chapter 3 section on economic conditions of the FEIS.
32. Some of these ideas are not parts of forest plan decisions such as area promotion and interpretive stops. It is not practical to acquire mineral rights for all recreation areas. The LRMP has objectives for acquisition of subsurface rights in many recreation areas. Management area direction and scenery objectives provide for limitations on logging impacts near areas of greatest recreational use.
33. The LRMP provides standards and guidelines for management and protection of clean air and water, erosion and sedimentation prevention, soil element retention and recreational opportunities. Where these are not sufficient, restoration activities can be undertaken at the project level to achieve the direction of the plan.
34. See response #1.
35. Promotion of community investment opportunities are beyond the scope of the forest plan.
36. Forest programs on environmental education are beyond the scope of the forest plan.
37. Trail construction and access for people with disabilities are project-level decisions. In the construction of new facilities the ANF complies with the American with Disabilities Act of 1990.
38. A comprehensive public health and safety program is outside the scope of the forest plan. Appendix G contains the Herbicide Use Risk Assessment, completed January 2006 that details the effects of herbicide application.

After the consideration described above the Allegheny Wild alternative was not analyzed in detail, but a number of elements in the proposal were brought into the alternatives considered in detail, especially Alternative D.

2.5.2 A Citizen's Wilderness Proposal for Pennsylvania's Allegheny National Forest by Friends of Allegheny Wilderness (FAW)

The Friends of Allegheny Wilderness submitted a proposal focused on creating new wilderness areas and other special area designations within the ANF. This proposal contains the following recommendations:

1. Create eight new wilderness areas in the following locations, totaling roughly 54,460 acres:
 - a. The Allegheny Front (6,906 acres)
 - b. Cornplanter (3,022 acres)
 - c. Tracy Ridge (9,705 acres)
 - d. A proposed area that totals 14,960 acres that includes the current Tionesta Scenic Area and Tionesta Research Natural Area
 - e. An addition of 1,780 acres to the Hickory Creek Wilderness Area
 - f. The area surrounding Indian Run headwaters, locally referred to as Chestnut Ridge (5,191 acres)
 - g. An area along the Clarion River (6,009 acres)
 - h. An area containing Morrison Run (6,887 acres)
2. Expand the existing Allegheny National Recreation Area by 4,752 acres, and to establish two new National Recreation Areas: Hearts Content NRA (2,335 acres) and Minister Valley NRA (7,390 acres).
3. Support traditional uses of the ANF, including timber harvesting (not in wilderness areas) and OGM development.
4. Support continued use of ATVs on designated trails.
5. Stop maintaining openings in wilderness areas.
6. Maintain the North Country Trail in any wilderness area.
7. Acquire OGM rights in wilderness areas and NRA.

The ANF considered these recommendations during the planning process, with the following response:

1. The ANF considered all of the areas recommended in this proposal through the roadless area inventory and wilderness evaluation as required by the forest planning process (see Appendix C). The Tracy Ridge, and Chestnut Ridge areas met the criteria for wilderness and the Allegheny Front area was also evaluated for wilderness. All of these areas are allocated to wilderness study areas in Alternative D and Chestnut Ridge is also allocated to Wilderness Study in Alternative Cm.

The Cornplanter, Tionesta, Hickory Creek, and Clarion River areas did not meet the criteria for wilderness as described in Appendix C. These areas were considered for other management that maintains natural character. Cornplanter, Tracy Ridge and Allegheny Front are managed consistent with their designation as a National Recreation Area in all alternatives. Clarion River is managed as a Remote Recreation Area (MA 7.2) in Alternatives B, Cm and D. The FAW Hickory Creek expansion is also managed as a Remote Recreation Area in Alternatives Cm and D. The larger Tionesta area proposed by FAW has had substantial roading, oil and gas development and timber harvest. As a result it was not introduced into the alternatives for specific natural area management. However in all alternatives the core Tionesta Scenic and Research Natural Areas are retained and Alternatives B, C and D manage portions of the area for late structural linkages (MA 2.2).

2. Minister Valley, recommended for designation as an NRA under the FAW proposal, met the requirements for consideration as a wilderness study area under the roadless area inventory, and is treated as a wilderness study area in Alternatives Cm and D. The other two areas that FAW propose for NRAs, Hearts Content and expansion of the Allegheny NRA, are being considered as remote recreation areas (MA 7.2) in Alternative Cm and D. The areas do not contain outstanding examples of recreation opportunities combined with scenic grandeur or other special attributes on a national scale to merit NRA designation. The linkage of natural areas sought by FAW between the Allegheny Front portion of the NRA and the Minister area is provided with the combination of NRA (MA 8.2), Remote Recreation Area (MA 7.2) and Wilderness Study Area (MA 5.2) in Alternatives Cm and D.
3. The LRMP provides for all of the traditional uses discussed.
4. The LRMP contains standards and guidelines that restrict ATV/OHM use to designated trails in designated areas.
5. Natural processes are generally expected in wilderness. Until wilderness is established created openings could be maintained in wilderness study areas. In the long term created openings are expected to naturally transition into forest conditions.
6. The LRMP contains a goal for management of the North Country Trail.
7. The LRMP contains objectives for the acquisition of subsurface mineral rights in wilderness, wilderness study and the national recreation areas.

The FAW proposal was considered and incorporated into the alternatives as described above.

2.5.3 Recreation and the Need to Increase Motorized Recreational Opportunities on the Allegheny National Forest by Allegheny Trail Riders

This proposal deals exclusively with motorized trails. The proposal suggests:

1. Planning for and building the entire 503 miles of trail and requisite support facilities that the 1986 Forest Plan EIS said the ANF could support.
2. Linking the trail system to private communities to encourage economic growth
3. Opening forest roads to motorcycles and ATVs to create a cross-forest trail system
4. Building a multifunctional campground accessible only by motorcycle or ATV
5. Increasing law enforcement to curb unauthorized riding
6. Using volunteers and partners to reduce the costs of improvements

Trail development is considered at the project level and the LRMP does not contain specific objectives to achieve a specific ATV/OHM trail mileage. However, concerns about ATV/OHM opportunities were considered during the planning process as follows:

1. Determining a reasonable number of ATV/OHM trail miles requires detailed site-specific information that is not part of the planning process. All of the areas identified in the 1986 Forest Plan are not suited for ATV development. The alternatives in the FEIS do consider a range of Intensive Use Areas (IUAs) specifically for ATV and motorized trail and bike trail development. Alternative D has the least amount of acreage in IUAs; Alternative B has the greatest.
2. The ANF explored opportunities to link IUAs to local communities and included a Forestwide objective to provide snowmobile trail system connectors to Tionesta, Ridgway, Sheffield, and Bradford. Additional opportunities may be explored during subsequent travel management planning and/or at the site-specific project level.
3. Safety concerns for joint-use designation of ATVs on open public roads was the primary reason why this suggestion was not considered further.
4. Such a site would be a project level decision and not within the scope of the plan. The plan does not preclude such a possibility on lands in IUAs.
5. The ANF does not condone illegal ATV/OHM use on the forest and actively enforces compliance.
6. The ANF embraces developing such partnerships. Methods to work with partners on ATV/OHM trail improvements are beyond the scope of the plan.

The Allegheny Trail Riders proposal was considered in the ANF planning process as described above.

2.5.4 Multiple-Use and Sustained Yield by Allegheny Alive

This proposal provides recommendations for recreation, timber management, and oil and gas development, and also discusses the benefits of silviculture for wildlife and the group's opposition to additional wilderness designations. The specific recommendations in the Allegheny Alive proposal include:

1. Provide for overnight accommodations in land areas zoned for a high level of development that is easily accessible.
2. Provide for more cabin development and developed RV campsites.
3. Provide interpretive trails and convert old railroad rights of way to hiking, biking and handicapped uses.
4. Provide for more motorized recreation opportunities (See Allegheny Trail Riders proposals).
5. Provide for expansion of snowmobile system:
 - a. Expand current system to a full 500 miles
 - b. Add forest roads and designate additional joint use roads.
 - c. Add connector trails to private services.
 - d. Add trailhead services such as expanded parking areas and toilet facilities
 - e. Use contractors of FS personnel to groom the designated trail system
 - f. Increase Ranger/Law enforcement
 - g. Plan placement of trails so snowmobilers can reach area communities
 - h. Maintain an interconnected trail to allow long distance touring.
6. Provide school group/nature tourism and driving tours on the ANF.
7. The ANF needs to fulfill its timber obligations of nondeclining flow of the existing forest plan and needs to:
 - a. Not reassign lands to management areas that would require less timber production
 - b. Not de-emphasize even-aged management
 - c. Increase the amount of early successional habitat
 - d. Provide a credible ASQ of no less than 69 MMBF

8. The ANF should not seek to purchase subsurface private oil and gas rights.
9. Additional wilderness on the ANF is unwarranted.

The ANF considered the Allegheny Alive recommendations as follows:

1. The determination of a site for substantial overnight accommodations is a site specific project consideration. The LRMP is a broad scale document that does not provide for such site specific detail. The LRMP does contain an objective to complete a management plan for the area around the Allegheny Reservoir to evaluate the type of recreational developments that would be desirable for this area. Overnight lodging would be considered as part of that management plan.
2. Overnight lodging such as cabins and RV campsites are possible in different parts of the forest consistent with management area standards and guidelines for recreational developments. Larger scale developments are allowed in MA 7.1.
3. Conversion of old railroads to trails is a site specific determination. The LRMP does not preclude development of these trails.
4. See responses to Allegheny Trail Riders proposal.
5. The ANF considered proposals to address snowmobile opportunities:
 - a. Determination of the extent of the trail system is a project decision and not a forest plan decision.
 - b. The LRMP contains an objective to evaluate adding roads for snowmobile use through the Travel Management process.
 - c. The LRMP contains an objective to work with appropriate partners to provide snowmobile connector trails to several local communities.
 - d. Trailheads and parking areas are a project decision and generally allowed in most of the ANF in the LRMP.
 - e. The LRMP contains an objective to facilitate grooming of the ANF snowmobile trail system.
 - f. The extent of law enforcement is not a forest plan decision.
 - g. See c. above.
 - h. See c. above
6. Education, tourism and driving tours are not part of the forest plan decision and would not be precluded except in a few specified management areas.

7. The ANF addressed opportunities to provide timber primarily through the alternatives.
 - a. Alternative A was provided specifically to maintain the current mix of management areas and their emphasis on timber production.
 - b. Alternative A maintains the current emphasis on even-aged management
 - c. The ANF explored options to increase the amounts of early structural habitat in the different alternatives. Within the limitations of National Forest law and policy, there is not an ability to provide a large increase in the amount of this habitat. Alternatives A, B and Cm would increase the amount of this habitat above current levels.
 - d. The level of timber harvest varied among the different alternatives. Consistent with the emphasis of the different alternatives, Alternative A identified an ASQ of 66.5 MMBF and Alternative B of, 63.1 MMBF.
8. The ANF does not generally seek to acquire subsurface rights. However, consistent with the need to conserve natural areas of the ANF, the LRMP has an objective to acquire these rights in these key natural areas.
9. Alternatives A and B provide for no additional wilderness.

2.5.5 Comments on Vegetation Management for the Allegheny National Forest Plan Revision by Allegheny Hardwood Utilization Group (AHUG)

This proposal makes specific recommendations to change existing vegetation management language in the 1986 Forest Plan. In summary, the proposal recommends:

1. Sustaining and developing the black cherry resource
2. Maintaining flexibility to use silviculture and harvest methods best suited to site-specific characteristics
3. Restoring areas affected by forest health concerns, regardless of management area
4. Creating better age-class diversity across the ANF

AHUG also provided recommendations on the plan outside vegetation management:

1. Holding deer populations at the capacity supported by the habitat and continue using hunters as the methods of deer control
2. Promoting landowner education on forest health, regeneration and succession, impact of deer, and need for wildlife habitat
3. Designating wilderness only on land not suitable for timber harvesting

4. Considering ANF certification as a pilot project for the FS
5. Prioritizing direct and indirect economic stimulus to the region

The ANF considered AHUG's recommendations as follows:

1. Alternative B specifically focused on emphasizing harvest and regeneration of Allegheny Hardwoods that feature black cherry.
2. Decisions regarding specific methods of timber harvest are a project level site specific decision, and not a plan decision. However, the LRMP does contain standards and guidelines and other information (Appendix A) that identify limitations or the appropriateness of certain practices in certain situations.
3. Generally, most management areas allow vegetative manipulation to address forest health concerns such as insect and disease problems, forest regeneration after a disturbance event, or treatment of non-native invasive species.
4. Improving the diversity of age classes and structural conditions is approached differently in all alternatives and was a major theme in their design. It is also a part of the desired condition with specific objectives in the LRMP.
5. The LRMP contains an objective to manage deer populations between 10-20 deer per square mile.
6. Education programs are generally outside of the scope of forest plan decisions.
7. Tradeoffs in the consideration of lands for wilderness versus other uses were considered. Alternative B contains no proposals for any additional wilderness. Of the four areas considered for wilderness, two (Tracy Ridge and Allegheny Front) would not result in further reduction of suitable land for timber production.
8. Although outside the scope of the plan revision, the ANF is participating in a study regarding certification.
9. Through the varying emphases on timber, recreation and the forest budget, the potential for the ANF to stimulate job and other economic opportunities is described in the FEIS.

Most of the suggestions of AHUG were incorporated into one or more of the alternatives under consideration (primarily Alternative B).

2.5.6 The Nature Conservancy (TNC)

The Nature Conservancy's comments centered on four recommendations:

1. Improving landscape connectivity and reserve design
2. Acquiring mineral rights in ecologically sensitive areas to achieve desired vegetation management
3. Reducing the impact of deer herbivory
4. Promoting or restoring native species composition, forest structure, and a mix of successional stages that reflects what would occur under a natural disturbance regime

The ANF has considered these recommendations in the following ways:

1. The LRMP approach to landscape linkages was carefully designed to provide for reserve and connectivity of late-structural habitat and relatively undisturbed habitat at the landscape scale. Varying distributions and amounts of reserve type areas are provided in MAs 5.1, 5.2, 7.2, 8.2, 8.3, and 8.5 and connective habitats (MA 2.2) are provided in Alternatives B, Cm, and D.
2. The LRMP contains goals and objectives for acquisition of subsurface rights in environmental sensitive areas.
3. The LRMP contains an objective to manage deer populations between 10-20 deer per square mile.

Alternative D was specifically created to analyze an alternative that focused on limiting forest disturbance to levels that were estimated to have occurred historically.

Most of the concerns identified by the Nature Conservancy were incorporated into Alternative D and to a lesser extent in Alternatives Cm and B.

2.5.7 Local Government Resolutions

A number of local governments (for a complete list see Appendix A) passed and sent individual resolutions to the ANF regarding 12 points they support for the future planning of the ANF. These points are generally:

1. Improved government communication and establishing a memorandum of understanding for procedures and protocol for coordinated dialogue.
2. 435,000 acres to be maintained for timber management and 10,000 acres annually addressed to reinvigorate forest health
3. 80 million board feet per year as the minimum level of timber harvest along with a departed harvest schedule for the immediate short term over and above the 80 million board foot level

4. Early structural habitat (0-20 years of age) encompassing 100,000 acres or 20 percent of the forest at any one time.
5. Oak areas open to various forms of forest management.
6. 120,000 acres dedicated for intensive recreation use including:
 - a. 300 mile ATV system
 - b. Motorized recreation trails increased to 1,000 miles
 - c. Increased parking capacity at trailheads
 - d. Construction of clean and modern restroom facilities at all trailheads
 - e. Connector trails into towns
 - f. Increased access to trails from private property
7. No creation of additional wilderness or 'de facto' wilderness
8. No landscape corridors
9. Accommodation of equine users
10. No fewer than 1000 jobs directly linking to ANF activities and an increase in employment value
11. Planning and site selection for inclusion of modern lodging facilities on or adjacent to the ANF.
12. A shoreline management strategy regarding the optimum utilization of the Kinzua Reservoir and all contiguous areas.

The ANF has considered the recommendations submitted in these resolutions in the following ways for its planning alternatives:

1. The ANF supports improved communication with local governments and has been taking considerable steps towards such improvement. The question of a MOU on government to government communication is outside the scope of the revised forest plan.
2. The ANF does not have the ability to manage 435,000 as part of the suitable land base. The ANF is limited to 408,000 acres of tentatively suitable land that can be considered for timber production. Alternatives A and B maintain the largest amount (406,600 acres and 391,700 acres respectively) of this land in management areas that are suitable for timber production. In the FEIS, Table 2-2 identifies the estimated annual levels of vegetative management activities associated with full implementation of the alternatives.

3. The alternatives identified by the ANF provide for high levels of timber production especially in Alternatives A and B at 66.5 MMBF and 63.1 MMBF. The departure harvest schedule analyzed for Alternative B does provide for 80 MMBF of production annually (see DEIS Appendix B for discussion). In addition to providing timber, the ANF must also address a variety of other legal requirements such as conservation of riparian areas, maintaining viability of vertebrate species, limiting size of created openings, etc. Alternative B was designed to provide for high levels of harvest consistent with meeting these other legal requirements.
4. As the timber benchmark analysis indicates it is not possible within the legal and policy constraints of national forest timber management and the tentatively suitable base to maintain 100,000 acres in the early structural conditions. Through the sixth decade, the alternatives generally range from 12,400 to 65,600 acres of land in early age classes at any one time (3-15% of the forest land on the ANF).
5. Approximately 28 percent of the oak forest types on the ANF are in congressionally designated areas (National Recreation Area, Wild and Scenic River, and Wilderness Areas) that preclude active timber management. Of the remaining 72 percent, the amount that is available for active even-aged timber management varies among the different alternatives from 46 to 70 percent.
6. Alternative B provides for 113,000 acres in land available for ATV/OHM trail use. In addition lands with developed recreation in MA 7.1 provide another 1,772 acres of intensive recreation opportunities. The specific mileage of trails that will be developed for these uses depends on a number of factors considered at the project level. The plan only identifies the suitability of different areas of the forest for such use. Other specific recreation questions (restrooms, specific connectors, parking capacity) are addressed at the project planning level.
7. As part of the revision process, the ANF is required to consider areas for potential wilderness study. This varies in the alternatives presented with two alternatives featuring no additional wilderness areas (Alternatives A and B) and two alternatives considering two and four additional areas (Alternatives Cm and D).
8. Alternative A does not provide a landscape corridor. The other alternatives provide a connective corridor that includes various levels of management directed at maintaining and restoring old forest conditions. This is an important element in addressing viability of a number of species on the ANF.
9. Opportunities for equestrian recreation activity vary across the alternatives with only Alternative D limiting large parts of the forest from equestrian activity.
10. The economic analysis in Chapter 3 of the FEIS estimates the number of jobs that are linked to activities on the ANF and each alternative. This section estimates that at least 1,000 jobs are contributed by the ANF and full implementation of Alternatives A and B have the potential to increase local employment by a 1,000 jobs.
11. Site selection and consideration of any lodging facilities on the ANF must be consistent with national forest direction and will be done at the project level, not in the forest plan.

12. The LRMP contains an objective to develop a comprehensive plan for the area surrounding the shoreline of the Allegheny Reservoir, including the Tracy Ridge and Cornplanter parts of the National Recreation Area.

Given the infeasibility of some of these suggestions and the fact that a number of these concerns are already being addressed in one or more of the alternatives, the recommendations in the resolutions were not analyzed as a full alternative in detail.

2.5.8 Other Alternatives Eliminated from Detailed Study

Most of the concepts that could be used to formulate alternatives and how they were considered have been addressed in the previous discussion in responding to the submitted citizen proposals. The ANF considered a number of other concepts for developing detailed alternatives.

Although some analysis was done relative to benchmarks (see Appendix B, Appendix E), the ANF did not elect to develop any of the benchmarks ranging from minimums to maximums as detailed alternatives. Benchmarks identify the range within which alternatives can be constructed. As benchmarks are not responsive to the purpose and need of the revision or respond to all of the identified issues, they were not developed further.

A number of other alternatives were considered but not developed in detail. For example, due to limitations associated with the shelterwood harvest method, the departure analysis of Alternative B could only begin accelerated harvest in later decades and thus would add little to the near term analysis. Consideration was given to another alternative with lesser or no amounts of MA2.2. Given that Alternative A does not include MA2.2 and in many respects produces results close to that of Alternative B, substantial additional insight would not be gained from this analysis.

Finally, as only small modifications were made to Alternative C to Cm, Alternative C was not analyzed in detail for the final FEIS.

2.6 A Comparison of Alternatives

This section contains the following three comparisons made of each alternative described in Section 2.4:

- Section 2.6.1 compares management area allocations by alternative and summarizes each management area.
- Section 2.6.2 compares the estimated level of management activities and outputs expected in the first and second decades.
- Section 2.6.3 compares how each alternative addresses the significant issues by displaying the evaluation criteria identified in Chapter 1.

The detailed disclosure of the effects for all resources is found in Chapter 3. The DEIS displayed estimates of activities by the planning period. The FEIS is presenting estimates of activities for decades one and two.

2.6.1 Management Area Allocation and Summary

The allocation of land to different management areas is the major building block of the alternatives considered. The LRMP uses the same basic structure of management areas from the 1986 Forest Plan, with minor changes (described below). The primary difference between the four alternatives is in how management area allocations are made to respond to the issues identified in Chapter 1.

Each management area has a unique emphasis, desired condition, list of suitable uses, and standards and guidelines. Each is described in the LRMP. The following list summarizes each management area and identifies changes in management area numbering from the 1986 Forest Plan. The description of the management areas is followed by a discussion on how the areas were delineated. Table 2.1 and the end of this section describes management area allocation by alternative. A map of the location of management areas under each alternative is provided in a separate map packet.

Certain management areas (primarily all MAs 5.x and 8.x) are considered to be special designations. Special designations are areas of the forest that either have or are recommended in the LRMP for a type of permanent designation that cannot be changed by subsequent forest plans. These special designations are established through congressional legislation (congressionally-designated) or administratively designated at the national level. Management areas that correspond to special designations are identified in the descriptions that follow as either congressionally or administratively designated areas.

Note that two overlay areas are identified in addition to the management areas listed below, Intensive Use Areas (IUAs) and Equestrian Use Areas (EUAs). The IUAs are the only areas of the ANF where ATV/OHM use is allowed and use is allowed on designated trails only. The EUAs are areas where equestrian use is limited to designated trails.

Table 2.1 displays the acreage assigned to each management area for each of the alternatives. A brief summary of the management areas follows the table. Further information on the management areas can be found in LRMP. Each management area is referenced in the table with an identifying number and its emphasis. The acreage assigned to each management area in each alternative is shown in the table. Note that management areas from the 1986 Forest Plan that were renumbered for the LRMP are shown first with the new number assigned in this process, and then with the number (marked by an asterisk) used in the 1986 Forest Plan.

Management area description

Management Area 1.0 Early structural habitat

MA 1.0 is managed for early structural habitat for a variety of game and non-game wildlife species, especially ruffed grouse. Vegetation management emphasizes a young forest of hardwood stands with interspersed conifers and openings suitable for a variety of wildlife species. Timber harvesting, reforestation activities, and wildlife habitat improvement is intensive. Trails and facilities support roaded natural recreational opportunities. Road construction and maintenance occur in this management area.

MA 1.0 is provided in all alternatives.

Management Area 2.0 Uneven-aged management (1986 Forest Plan)

This MA is renumbered as MA 2.1.

Management Area 2.1 Uneven-aged management

This management area is managed for a continuous high crown canopy consisting of primarily shade tolerant and intermediate vegetation with interspersed small temporary openings and associated plant and animal species. Uneven-aged vegetation management provides a continuous, forested scene that promotes shade tolerant species and produces quality sawtimber. Harvesting includes frequent and repeated treatments to achieve management objectives. Wildlife management emphasizes species associated with shade tolerant vegetation, primarily songbirds and cavity-nesting birds and mammals. This management area provides limited opportunities for dispersed recreation, motorized recreation, hunting, and fishing in a roaded natural setting. Forest Service roads are generally closed or restricted to public traffic, except for certain seasonal openings.

MA 2.1 is provided in Alternatives A, Cm, and D.

Management Area 2.2 Late structural linkages

MA 2.2 is managed for older, late-structural forests that link relatively large areas of older forests (core areas) across the landscape. Vegetation management consists of a blend of uneven-aged, even-aged and passive (no) treatments, and is directed towards restoring late-structural forest habitat with an emphasis on sustaining forest structure and forest continuity. An early structural component consistent with historic disturbance regimes for the Allegheny Plateau would be sustained. Wildlife management emphasizes species with viability concerns, remote and interior species with high sensitivity to disturbance, and protection of unique micro and macro habitats (e.g. rock/boulder outcroppings and seasonal nesting and cover habitat). This management area provides a variety of opportunities for recreation in a roaded natural setting. Most existing roads are closed in this management area, and new Forest Service roads will be limited and restricted to existing road corridors. Trails and facilities support roaded natural recreation opportunities, and new motorized trails will be minimized. Facilities such as trailheads and parking areas will be located on the periphery of the management area.

MA 2.2 is provided in Alternatives B, Cm, and D.

Management Area 3.0 Even-aged management

MA 3.0 is managed for a mix of early and late structural forest conditions. This management area provides a sustained yield of high-quality timber products that contribute to the local and regional economy. Vegetation management emphasizes even-aged management to provide a forest that is a mix of predominantly hardwood stands of various ages and associated understories, and habitat for a diversity of plant and animal species. Treatments are directed towards balancing age class distribution in MA 3.0. Wildlife management emphasizes early-structural species, including white-tailed deer in all forest types, and squirrel in oak forest types. Specialized habitats and inclusions within the management area receive treatments to specifically benefit game and non-game species, and certain species with viability concerns. Trails and facilities support roaded natural recreational opportunities. Road construction and maintenance occur in this management area.

MA 3.0 is provided in all alternatives.

Management Area 5.0 Wilderness (1986 Forest Plan)

This management area is divided into MA 5.1 (Designated Wilderness) and MA 5.2 (Proposed Wilderness Study Areas).

Management Area 5.1 Designated wilderness

MA 5.1 is managed for protection of congressionally designated wilderness. Management emphasizes the maintenance of wilderness values consistent with the Wilderness Act of 1964 and subsequent legislation. This management area provides outstanding opportunities for unconfined recreation, including exploration, solitude, risk, and challenge in a semi-primitive non-roaded ROS setting. Vegetation changes are left primarily to forces of nature. The area exists without roads or facilities, but trails are present in the management area. No new Forest Service roads will be built in this management area.

MA 5.1 is provided in all alternatives.

Management Area 5.2 Proposed wilderness study area (Special Designation)

This management area is managed for the protection of wilderness study areas (WSAs). Management emphasizes the maintenance of wilderness values consistent with potential future designation as wilderness. This management area provides outstanding opportunities for unconfined recreation, including exploration, solitude, risk, and challenge in a semi-primitive non-roaded ROS setting. Vegetation changes are left primarily to forces of nature. The ANF will not construct new roads or facilities in these areas. The area may continue to maintain existing roads or facilities, as long as there is no further development that would compromise possible wilderness designation.

MA 5.2 is provided in Alternatives Cm and D, only.

Management Area 6.1 Late structural habitat

MA 6.1 is managed for conserving wildlife habitats, especially mature hardwood forests (e.g. for turkey, bear, and cavity-nesting birds and mammals). Vegetation treatments, primarily even-aged, are directed to meeting the primary purpose with an emphasis on sustaining forest structure and continuity to benefit small and non-game species, and species with viability concerns. This management area provides a variety of dispersed recreation activities in a roaded natural setting. Current roads remain in place and new roads will be limited and restricted or closed when not needed. Facilities to support recreation will be placed on the periphery of the management area.

MA 6.1 is provided in all alternatives.

Management Area 6.2 10/30 Even-aged management

MA 6.2 is managed for hardwood sawtimber production and a setting suitable for dispersed non-motorized recreation for 30 out of every 40 years. The management area is divided into four blocks which are harvested on a rotating schedule. Timber harvesting (primarily even-aged) and reforestation occur in a 10-year, intensive management period which occurs once every 40 years. During this 10-year period, road construction and motorized recreation may occur on certain roads within the management area. After this 10-year period, Forest

Service roads will be closed and revegetated. Non-motorized dispersed recreation activities are emphasized during the remaining 30 years of the 40-year cycle.

MA 6.2 is provided in Alternative A only.

Management Area 6.3 Buzzard Swamp Wildlife Management Area

MA 6.3, the Buzzard Swamp Wildlife Management Area, is managed for wildlife habitat improvement and maintenance through a cooperative agreement with the Pennsylvania Game Commission. It is intensively managed for high populations of wildlife species, especially waterfowl, furbearers, and warm water fish. Vegetation management emphasizes habitat improvement and includes treatments such as planting, fertilizing and mowing of food plots, shrub planting, and tree pruning. This management area provides a variety of dispersed recreation activities particularly hunting, fishing, and wildlife observation in a roaded natural recreation setting. Trail and roads occur within this management area.

MA 6.3 is provided in all alternatives.

Management Area 6.4 National recreation area (1986 Forest Plan)

This management area is renumbered as MA 8.2.

Management Area 7.0 Developed recreation (1986 Forest Plan)

This management area is renumbered as MA 7.1.

Management Area 7.1 Developed recreation area

MA 7.1 is managed for large-scale developed recreation areas in a rural setting. This management area is primarily used in the summer months, and often provides a destination for visitors to use as a staging area for participating in other day use activities on the ANF (e.g. ATV riding, boating, fishing, hunting, sight seeing, driving for pleasure, horseback riding, biking, and hiking). Vegetation management is limited and is used primarily to support recreational and scenic objectives. Road and facilities development for recreation are featured here including road and trail construction and maintenance, campgrounds, sanitation facilities, water systems, electrical hookups, picnic areas, boat launches, and covered group sites and shelters.

MA 7.1 is provided in all alternatives.

Management Area 7.2 Remote recreation area

MA 7.2 is managed for recreation and wildlife habitat in relatively large, undeveloped areas that are primarily unroaded. Recreational use for both summer and winter activities is non-motorized. Vegetation management is limited to supporting primarily recreational and wildlife management objectives. Unless needed for recreational use or to meet existing private rights, existing roads will be decommissioned or converted to trails. There will be no additional Forest Service roads built in this management area. Small-scale facility construction to support non-motorized recreation may occur. Areas larger than 2,500 acres are managed to an ROS class of semi-primitive non-motorized, while those smaller are managed to an ROS class of roaded natural.

MA 7.2 is provided in Alternatives B, Cm, and D.

Management Area 7.3 Interpretive recreation area

MA 7.3 is managed for protection, maintenance and interpretation of unique natural and historic areas with an emphasis on non-motorized recreation in a roaded natural setting. Vegetation management is limited to supporting primarily recreational and wildlife management objectives. Existing roads may be maintained, but no new Forest Service roads will be constructed.

MA 7.3 is provided in Alternative B only.

Management Area 8.0 Special area management (1986 Forest Plan)

This management area is divided into six new management areas (MAs 8.1-8.6). All of the management areas that begin with 8 are special designations.

Management Area 8.1 Wild and scenic river corridor (special designation)

MA 8.1 is managed to protect Congressionally-designated Wild and Scenic River (WSR) corridors. Vegetation management focuses on protecting and enhancing the outstandingly remarkable values that led to WSR designation. Wildlife management in this management area emphasizes habitat enhancement for threatened and endangered species such as the bald eagle and freshwater mussels. Roads will be limited to those needed for public access, service, or maintenance.

Both recreational and scenic river segments, with some differences in management emphasis, are in this management area. Scenic segments maintain very high scenic integrity. Recreational opportunities are provided in roaded natural (along scenic river segments) and rural (along recreational river segments) settings. Along the recreational river segments, recreational facilities including level 4 facilities may be present.

MA 8.1 is provided in Alternatives B, Cm, and D. Note that Alternative A recognizes the scenic and recreational river segments in the 1986 Forest Plan as an overlay to protect the outstandingly remarkable values of these rivers.

Management Area 8.2 National recreation area (special designation)

MA 8.2 is managed for protection of the Allegheny National Recreation Area (NRA), established by the Pennsylvania Wilderness Act of 1984 (Public Law 98-585). The primary emphasis is to provide outdoor recreation opportunities in a relatively large expanse of predominantly natural landscapes. Vegetation management is limited, and emphasizes maintenance of the natural, undeveloped character of these areas while providing high-quality scenic and recreational opportunities for the public. Recreation trails and facilities are constructed and maintained to the appropriate development level associated with semi-primitive non-motorized recreation. No new Forest Service roads will be built in this management area. Note: Tracy Ridge Campground, included in MA 8.2 under Alternative A is designated as MA 7.1 in Alternatives B, Cm, and D.

MA 8.2 is provided in all alternatives.

Management Area 8.3 Scenic area (special designation)

MA 8.3 is managed for protection and maintenance of two administratively-designated scenic areas on the ANF: Tionesta and Hearts Content. Both areas are on the National Registry of Natural Landmarks in recognition of their significant ecological and historical values, and specifically because they each contain some of the last “old growth” remnant forests in Pennsylvania. Vegetation management activities are limited and focus on maintaining the natural, undeveloped character of these areas while providing high-quality scenic and recreational opportunities for the public. Trails systems are designed and maintained to be in harmony with the environment. Recreation opportunities are provided in a roaded natural setting. No new Forest Service roads will be constructed, but existing roads may remain.

MA 8.3 is provided in all alternatives.

Management Area 8.4 Historic area (special designation)

MA 8.4 is managed for protection, maintenance, and interpretation of the Buckaloons Heritage Area as an administratively-designated special interest area. Buckaloons contains a significant concentration of historic and prehistoric sites which are valued for heritage, research, education, interpretation, and tourism. Vegetation management is limited to activities consistent with this emphasis. Recreational opportunities are provided in a roaded natural setting. Facilities may be provided or enhanced for public use or resource protection. Construction of new roads and facilities may occur for recreation and interpretation purposes.

MA 8.4 is provided in all alternatives.

Management Area 8.5 Research natural area (special designation)

MA 8.5 is managed for preservation and protection of ecologically-significant natural features, high-quality representative ecosystems, and unique areas of the administratively-designated Tionesta Research Natural Area (RNA). The Tionesta RNA is on the National Registry of Natural Landmarks in recognition of its significant ecological and historical values. In particular, it has been characterized as the “largest virgin forest in the hemlock-white pine/northern hardwoods region of North America.”

The emphasis in this management area is to maintain unmodified conditions for research, study, observation, monitoring, and educational activities. Vegetation management will be limited, but may occur to protect against defoliation and disease. Wildlife activities are primarily non-manipulative research activities. Construction of new roads, trails and facilities will be prohibited, and recreational use will be limited.

MA 8.5 is provided in all alternatives.

Management Area 8.6 Kane Experimental Forest (special designation)

MA 8.6 is managed for research and demonstration purposes on the administratively-designated Kane Experimental Forest (KEF). Most management activities are appropriate for this area as long as they are developed as part of research projects. This management area may also provide some production of wood products, conservation of wildlife, and provide dispersed recreation opportunities in a roaded natural setting.

Trails and facilities may be constructed, but new Forest Service roads will be limited. Leadership for the selection and evaluation of projects in the KEF is provided by the Northern Research Station in cooperation with the ANF.

MA 8.6 is provided in all alternatives.

Management Area 9.1 Managed with minimal investment

MA 9.1 is managed with minimal investment to emphasize natural ecosystem processes. In this management area, the land condition is dominated by vegetation progressing through a natural succession process to mature and over mature hardwood and softwood forests. Natural forces play a dominant role in site or vegetation change. Vegetation management occurs primarily to protect the life, health, and safety of incidental forest users and to prevent significant loss of existing resources or productivity on the site or in adjoining areas.

MA 9.1 is provided in Alternative A only.

Management area delineation

Management area delineation for forest planning occurs at a broad, landscape scale. This is an iterative process that uses a variety of spatial data of varying accuracy and precision, and incorporates goals, objectives, science, changed conditions, public input, and professional judgment. This interdisciplinary approach ensures that the final range of alternatives address the significant issues and concerns. A variety of methodologies, criteria, information and the best available data are used to determine the best placement of boundaries to meet the intent of the management area.

The ANF geographic information system (GIS) was the primary tool used for mapping management areas. Management area delineation and mapping was initially based on management areas defined in the 1986 Forest Plan as currently mapped in the ANF GIS. Alternative A represents the existing condition of management area allocation. Alternatives to the current management area allocation were then developed for Alternatives B, Cm, and D based on the existing condition and significant issues identified through the planning and public participation process. Revised boundaries are based on different allocations identified in the alternatives. Existing congressionally and administratively designated area boundaries did not change. These include MAs 5.1, 8.2, 8.3, 8.4, and 8.5. The wild and scenic river corridor (MA 8.1) was based on application of the Wild and Scenic Rivers Act of 1968 (Appendix D). Lands adjacent to Kane Experimental Forest (MA 8.6) were identified for expansion of KEF based on forest cover types and the need for additional dedicated lands to conduct research.

Alternatives B, Cm, and D added wilderness study areas (MA 5.2), which were delineated based on the updated roadless area inventory and wilderness evaluation process which provided guidance on boundary determination (Appendix C). Areas that were included in the alternatives as remote recreation areas (MA 7.2) used work done in the revised roadless inventory to identify boundaries. This included review and consideration of area boundaries submitted by the Friends of Allegheny Wilderness and the Allegheny Defense Project.

Alternatives B, Cm, and D added late structural linkages (MA 2.2). This MA was developed to connect core areas (relatively large areas of older forests) across the landscape. The core areas included MAs 5.1, 5.2, 7.2, 7.3, 8.2, 8.3, and 8.5. The boundary delineation was initially based on the 1995 proposed landscape corridor framework

(USDA-FS 1995d), which coincides closely with existing MA 6.1. Configurations for MA 2.2 provided wider connections and multiple connectors as they range from Alternatives B through D. GIS was used to determine the spatial location of the late structural linkages to best meet the goals and objectives identified for MA 2.2, using a suite of landscape characteristics (FEIS Chapter 3, Plant and Animal Habitat). The boundary was adjusted through an interdisciplinary team process using district knowledge of current and anticipated future conditions on the ground. Public comment and professional judgment lead to further boundary refinements of MA 2.2 in Alternative Cm.

The remaining management areas vary by alternative primarily as a result of changes in the MAs previously discussed. MAs 1.0 and 6.3 remained relatively similar in all alternatives, except where MA 2.2 was applied. MA 2.1 mapped areas were the same in Alternatives A and Cm, except where MA 2.2 is applied in Cm. The expanded configuration of MA 2.1 in Alternative D was based on grouping northern and upland hardwood forest types into larger management units. The majority of MA 6.1 was incorporated into MA 2.2. Some areas of MA 6.1, as identified in Alternative A, were included in the other alternatives based on their capability to provide late structural habitat. MA 7.1 was revised from Alternative A to better define the extent of developed recreation areas. MA 7.3 was mapped to reflect an area that has unique, natural and historic value for interpretation and only occurs in Alternative B. MAs 6.2 and 9.1 were included in Alternative A only and no additional mapping was done for these areas. MA 3.0 primarily included lands outside of the other assigned management areas.

Table 2-1. Management area allocation by alternative (Acres)

MA #	Emphasis	Alternatives			
		A	B	Cm	D
MA 1.0	Early Structural Habitat	7,955	7,575	7,937	6,215
MA 2.1 (*2.0)	Uneven-aged Management	3,617	0	2,837	125,746
MA 2.2	Late Structural Linkages	0	99,482	121,176	128,781
MA 3.0	Even-aged Management	307,770	330,190	287,380	122,831
MA 5.1 (* 5.0)	Designated Wilderness	8,979	8,979	8,979	8,979
MA 5.2	Wilderness Study Area	0	0	12,379	29,981
MA 6.1	Late Structural Habitat	126,904	11,922	16,421	28,377
MA 6.2	10/30 Even-aged Management	21,297	0	0	0
MA 6.3	Buzzard Swamp Wildlife Management Area	1,167	1,122	1,122	1,122
MA 7.1 (*7.0)	Developed Recreation Area	1,040	1,772	1,772	1,477
MA 7.2	Remote Recreation Area	0	4,668	9,074	30,948
MA 7.3	Interpretive Recreation Area	0	3,367	0	0
MA 8.1	Wild and Scenic River Corridor (NF land)	0	9,250	9,250	9,215
MA 8.2 (*6.4)	National Recreation Area	20,502	20,152	20,152	4,807
MA 8.3 (*8.0)	Scenic Area	2,115	2,115	2,115	2,115
MA 8.4 (*8.0)	Historic Area	306	306	306	306
MA 8.5 (*8.0)	Research Natural Area	2,111	2,111	2,111	2,111
MA 8.6 (*8.0)	Kane Experimental Forest	1,737	3,463	3,463	3,463
MA 9.1	Managed with Minimal Investment	974	0	0	0
Total Acres (ANF lands)		506,474	506,474	506,474	506,474
Overlay Acres					
Intensive Use Areas	ATV/OHM Use	98,974	113,019	83,202	40,519
Equestrian Use Areas	Equestrian Use	0	10,585	10,585	49,934

Table 2.2. Past management activity levels and future projected management activities (annual average/year except where noted) by alternative for decades one and two

Management Activity	Past Level (1986-2005)	Alt A		Alt B		Alt Cm		Alt D	
		Decade		Decade		Decade		Decade	
		1	2	1	2	1	2	1	2
Even-aged Vegetation Mgt. (Acres)									
Intermediate Thinning Harvests	2,594	1,363	1,149	1,035	654	1,000	1,000	195	317
Shelterwood Seed Cut Harvests	969	2,070	2,206	1,950	2,114	1,835	1,715	50	56
Regeneration Harvests (Shelterwood Removal Cut &, or Clearcut with reserves)	1,424	2,423	2,043	2,341	1,917	1,754	1,673	699	812
Uneven-aged Vegetation Mgt. (Ac)									
Uneven-aged Harvests+	327	6	0	403	326	666	320	300	300
Riparian Areas (Acres)									
Riparian Enhancements ++	NE	(103)	(107)	(97)	(99)	(96)	(92)	(61)	(64)
Road Management (Miles)									
Road Construction/ Existing Corridor	NE	13	13	14	14	13	13	11	11
Road Construction New Corridor	9*	8	8	7	7	5	5	5	5
Road Reconstruction	7**	100	100	100	100	100	100	100	100
Road Decommissioning	2	2	2	2	2	2	2	3	3
Forest Road System (total by end of decade)	1,269 (Existing)	1,459	1,649	1,459	1,649	1,429	1,589	1,399	1,529
Additional Acres Cleared for Gravel Pits	NE	5	5	5	5	5	5	5	5
Understory Vegetation Treatments (Acres)									
Herbicide –Reforestation	977	1,785	1,524	2,062	1,683	2,368	1,631	756	931
Herbicide - Wildlife	10	20	20	105	105	105	105	90	90
Herbicide - Non-Native Invasive Sp.	0	0	0	110	110	110	110	110	110
Non-Native Invasive Species Control	30***	500	500	500	500	500	500	500	500
Fencing	735	1,054	1,138	1,285	1,331	1,701	1,429	501	791
Fertilization	766	364	384	343	388	215	228	98	87
Prescribed Burning - Silviculture	11***	65	65	100	109	104	99	8	8
Prescribed Burning - Wildlife	53	90	90	300	300	300	300	150	150
Prescribed Burning - Hazard Fuels Reduction	8	125	125	250	250	250	250	200	200

Management Activity	Past Level (1986-2005)	Alt A		Alt B		Alt Cm		Alt D	
		Decade		Decade		Decade		Decade	
		1	2	1	2	1	2	1	2
Scarification for Oak	41** *	65	65	100	109	104	99	8	8
Release for Species Diversity	531***	1,562	1,837	1,630	1,997	1,727	2,271	774	1,042
Site Preparation	1,385	1,477	1,575	1,686	1,746	1,992	1,658	631	865
Wildlife and Fish Management									
Wildlife Opening Creation (Ac)	10	10	10	20	20	15	15	8	8
Wildlife Enhancements (Ac)	2,100	2,100	2,100	1,600	1,600	1,600	1,600	1,200	1,200
Stream Restoration (Mi)	0	0	0	2	2	2	2	2	2
Fish Habitat Structures (Ac)	41***	0	0	32	32	32	32	32	32
Recreation Trails Management (Mi)									
Motorized Trail Construction +++	4	5	5	8	8	4	4	2	2
Motorized Trail System	474 (Existing)	524	574	554	634	514	554	494	514
Non-motorized Trail Construction++++	5	5	5	5	5	5	5	5	5
Non-motorized Trail System	271 (Existing)	321	371	321	371	321	371	321	371
Recreation Management (Each)									
Dispersed site enhancement in CUAs	0	1	1	1	1	1	1	1	1
Construction/reconstruction of developed facilities	71 (Existing)	2	1	2	1	2	1	2	1
Wilderness Areas managed to standard	0	2	2	2	2	4	4	6	6
Economics									
Budget (Thousands, 2005 dollars)	\$16,814*****	\$27,854	\$28,298	\$28,301	\$28,702	\$26,358	\$25,778	\$17,936	\$18,985
Revenue (Thousands, 2005 dollars)	\$18,070*****	\$69,066	\$70,840	\$64,554	\$67,502	\$53,411	\$51,303	\$27,176	\$24,354

+ Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

++ Acres of riparian treatments are included in the activities listed above them

+++ ATV/OHM/Snowmobile

++++ Hike/Bike/Horse

* Represents total road construction (past levels were not tracked by new or existing corridor)

** Average number is low due to change from past definition of reconstruction. Numbers going forward include heavy maintenance activity.

*** Treatment only applied past 5 years.

**** Treatment only applied on ANF for the past 10 years

***** Average from 2001-2005

NE = Not Estimated

2.6.2 Estimated Management Activities/Outputs

Table 2.2 displays estimates of the management activities that may occur in decades 1 and 2 under each of the alternatives. The LRMP does not make decisions about specific management activities. Each of those decisions must be made in an individual environmental document. Table 2.2 provides an estimate of the amount of these activities that could occur with the full implementation of the identified alternative. Although there are a few exceptions (described below) most of these activities are described as an average annual level expected to occur during the first and second decades (2006-2015 & 2016-2025). The estimated activity levels are based on an assumption of full funding to achieve plan objectives.

Past comparable activity levels are displayed first to reflect current funding levels. Alternative A projects some levels at zero, because they were not analyzed at the time of the 1986 Forest Plan.

The items described in the table are:

Even-aged intermediate thinning harvests

This displays the average annual acreage scheduled for timber harvest activities that remove a portion of the standing trees to reduce the density of standing trees. Thinning activity may occur to improve stand vigor, accelerate growth, or to reduce forest health risks by concentrating growth on healthy trees and removing those at risk of decline or dying. The acres displayed are limited to lands where even-aged regeneration harvest is anticipated to occur, usually within 20-30 years following the thinning activity.

Even-aged shelterwood seed cut harvests

This displays the average annual acreage scheduled for a shelterwood seed cut, the first step in an even-aged shelterwood regeneration system. A shelterwood system treatment is used on sites where it is desirable to establish tree regeneration and there is an opportunity on the landscape to increase the seedling component to achieve wildlife and/or age-class diversity objectives by completing the later removal harvest. In the shelterwood seed cut, about one-third of the overstory trees are removed to increase sunlight levels to the forest floor for seedling development. Once adequate tree seedlings develop, usually in 3 to 15 years, but sometimes as late as 20 years, the second step called the shelterwood removal cut would occur (see explanation in the next subsection), allowing nearly full sunlight for seedlings to quickly grow.

Even-aged regeneration harvests (shelterwood removal cut and/or clearcut with reserves)

This displays the average annual acreage scheduled for regeneration through even-aged management techniques. Regeneration means the replacement of most of an existing stand with a younger stand of tree seedlings. The ANF predominantly uses a shelterwood system that involves two entries on the same area to achieve regeneration. Some of these treatments in the first decade occur where existing shelterwood seed cuts have already been completed. In some forest types the shelterwood removal listed here will result from a shelterwood seed cut made in the same decade listed under the previous line in the table (some stands will be listed in both places). In nearly all cases, areas regenerated using even-aged silvicultural systems retain trees (referred to as reserves) that serve as biological and structural legacies of the stand over the long term.

Uneven-aged harvests

This displays the average annual acreage scheduled for timber harvest activities that removes a portion of the standing trees with the management objective of establishing at least three distinct age classes over time. The acreage displayed reflects the acreage that would receive the first entry harvest to transition an even-aged stand towards an uneven-aged stand. There are three distinct treatments grouped under this heading. These include an intermediate improvement cut, which is designed to improve stand quality and transition the structure towards that of an uneven-aged forest; single tree selection, which removes individual trees with the intent of developing tree seedlings on the forest floor; and group selection, which removes groups of trees in each entry to create a distinct age class. These harvests will create or perpetuate a situation of trees of multiple ages occurring within the same general area and will require repeated entries for harvesting on 15-30 year intervals. The acreage only reflects first entry harvests. Subsequent entries to treated areas are not displayed in this table.

Riparian enhancement (Note these acres are included in the totals listed previously in the table for even and uneven-aged management).

This identifies the acreage of riparian enhancement harvest activities scheduled to occur within riparian areas. These harvests are designed to improve vegetative diversity and enhance vertical and big tree structural characteristics to enhance the values of riparian areas.

Road construction/existing corridor

This identifies the average annual mileage of Forest Service roads that are estimated to be improved and added to the FS system. These roads are built utilizing existing road corridors from oil and gas roads, old railroads or other road corridors.

Road construction/new corridor

This identifies the average annual mileage of Forest Service roads that are estimated to be constructed during the planning period. These roads are built with new road grades where roads presently do not exist. Some would require rights-of-way for access to NF lands.

Road reconstruction

This is the average annual mileage of FS or local government roads estimated for reconstruction work. Reconstruction includes surface rock or culvert replacement as well as improvement and realignment of existing roads.

Road decommissioning

This is the average annual mileage of roads that would be decommissioned and unavailable for use by all motor vehicles. This includes the removal of all roads in conflict with the management direction of the alternative plus anticipated project-level decisions to decommission unneeded roads over the next two decades. This does not include nonsystem roads that may be decommissioned at the site-specific project level.

Forest road system

This is the current level of the ANF road system and the number of miles in the FS road system at the end of decades one and two. It is the sum of the number of miles of existing and new roads minus the number of miles of roads decommissioned.

Additional acres cleared for gravel pits

This is an estimate of the additional acres of gravel pits needed for FS road construction and reconstruction on the ANF annually.

Herbicide treatment

This is the estimated average annual acreage of the ANF anticipated to be treated with herbicides. The estimated acreage is broken out by acres of treatment to support reforestation, wildlife improvements, and to eliminate non-native invasive species.

Non-native invasive species control

This is the estimated average annual acreage of the ANF treated to eliminate or suppress non-native invasive species. This includes manual and mechanical treatments.

Fencing

This is the estimated average annual acreage of the ANF to be fenced to protect understory vegetation development. This displays the area actively fenced within a year, rather than the total area fenced from new and old fencing.

Fertilization

This is the estimated average annual acreage of the ANF to be treated with fertilizer for growth enhancement of tree seedlings.

Burning

This is the estimated average annual acreage of the ANF to be treated with prescribed burning. The estimated acreage is broken out by acres of treatment to support forest regeneration, to support wildlife improvements, and to reduce hazardous fuels.

Scarification for oak

This is the estimated average annual acreage of the ANF to be treated with scarification (30% disturbance of organic layer) to regenerate oak.

Release for species diversity

This is the estimated average annual acreage of the ANF to be treated with non-herbicide mechanical release treatments that reduce competing vegetation for desired tree seedlings to grow.

Site preparation

This is the estimated average annual acreage of the ANF to be prepared for regeneration silvicultural activities by mechanical felling of unmerchantable stems.

Precommercial thinning

This is the estimated average annual acreage of the ANF that will have treatments to remove or fell some trees non-commercially so that the remaining trees will grow faster.

Full planting tree seedlings

This is the estimated average annual acreage of the ANF to have planting of tree seedlings where low stocking is a concern.

Mechanical hazardous fuel treatments

This is the estimated average annual acreage of the ANF to have hazardous fuel treatments (reduction of fuels available for wildfire) through mechanical (non-burning) methods.

Wildlife opening creation

This is the estimated average annual acreage of the ANF to be converted into permanent openings to support wildlife that use open conditions.

Wildlife enhancements

This is the estimated average annual acreage of the ANF to be treated with wildlife enhancements.

Stream restoration

This is the estimated average annual mileage of streams structurally restored suitable to aquatic habitat conditions.

Fish habitat structures

This is the estimated average annual acreage of fish habitat improvement/enhancement. These improvements include the placement of structures in impoundments.

Motorized trail construction

This is the estimated annual average of construction and reconstruction of ATV/OHM/snowmobile trails.

Non-motorized trail construction

This is the estimated annual average of construction and reconstruction of hiking, bike, and horse trails.

Motorized trail system

This is the total estimated mileage of all motorized trails.

Non-motorized trail system

This is the total estimated mileage of all nonmotorized trails.

Dispersed site enhancement in concentrated use areas

This is the annual average of dispersed site improvement and may include site hardening, kiosk construction, addition of fire rings or centralized vault toilets.

Construction/reconstruction of developed facilities

This is the annual average of construction or reconstruction of developed facilities including day use areas, campgrounds, information sites, and trailheads.

Wilderness areas managed to standard

Number of wilderness areas managed to standard, based on the number of designated wilderness or recommended wilderness study areas per alternative.

ANF budget

This is the estimated average annual budget needed to support full implementation in 2005 dollars. Note the past level for this item is an average from 2001-2005.

ANF revenues

This is the estimated average annual revenues of the ANF in 2005 dollars based on full implementation. Note the past level for this item is an average from 2001-2005.

2.6.3 How the Alternatives Addressed the Issues (Display of Evaluation Criteria)

Table 2.3 displays how the alternatives address the issues identified in Chapter 1. The items displayed in the table are also known as evaluation criteria or a set of indicators used to compare how the alternatives respond to the issues and their various components identified in Chapter 1. The nature of the items displayed varies depending upon the particular issue. Some are summaries related to the land allocations of the alternatives, others are estimates of activities, conditions or outputs (rounded to the nearest 100) anticipated under the alternative in the first or second decade, and others may present other specific items related to the alternatives. These specific items are described in more detail in Chapter 3 of this EIS. Some may be described in further detail in Appendix B.

Table 2-3. Evaluation criteria by issue and alternative

FOREST VEGETATION MANAGEMENT									
		Alternative A		Alternative B		Alternative Cm		Alternative D	
Vegetation Composition - Predicted Forest Type Conversions									
Current condition (2005) and forest types predicted in each alternative for decades 2 and 6 shown as % of forested land (463,500 acres in decade 2 and 436,800 acres in decade 6). The amount and nature of management activities (including shifts that occur under no active management) are the primary factors influencing the future mix of forest types in the alternatives. Note: See Forest Composition Section in Chapter 3 for discussion of possible changes to forest types. (Data shown is for the mid-point of the decade.)									
	2005	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6
Upland Hardwood	33%	34%	45%	34%	45%	34%	47%	34%	49%
Allegheny Hardwood	28%	27%	21%	27%	21%	27%	21%	27%	18%
Northern Hardwood	16%	16%	13%	16%	13%	16%	12%	16%	13%
Oak Types	16%	16%	14%	16%	14%	16%	14%	16%	14%
Vegetation Age- Percent of forested acres by age class									
Estimated percentage in each identified age class group in decades 2 and 6 from base of 442,600 acres of forested land on the ANF. Areas selected for uneven-aged management in the future have no age class assigned and will contain multiple ages and thus are not associated with a particular age group. Note: Span of age classes differ, zero acres are identified under uneven-aged management at the present time, and old growth (located in Tionesta Scenic and Research Natural Areas & Hearts Content Scenic Area) remain constant by alternative. (Data shown is for the mid-point of the decade.)									
	2005	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6
0-20	8%	10%	15%	10%	14%	8%	11%	5%	3%
21-50	6%	11%	14%	11%	13%	11%	12%	11%	5%
51-80	26%	9%	10%	8%	10%	8%	10%	7%	10%
81-110	57%	59%	4%	57%	4%	58%	4%	53%	5%
111-140	3%	10%	34%	10%	33%	10%	36%	11%	36%
141-300	0%	<1%	22%	<1%	22%	<1%	22%	<1%	28%
301+	<1%	1%	1%	1%	1%	1%	1%	1%	1%

Table 2-3. Evaluation Criteria by Issue and Alternative (continued)

	Alternative A		Alternative B		Alternative Cm		Alternative D	
Silvicultural Systems Used - Total acres allocated by dominant silvicultural system based on Management Areas Even-aged silvicultural systems are scheduled in MAs 1.0, 2.2, 3.0, 6.1 & 6.2. Uneven-aged silvicultural systems are scheduled in MAs 2.1 & 2.2. MA 2.2 (Landscape Linkages) has percentages of area assigned to even-aged, uneven-aged, and no active management based on current access and forest type. Areas with no silvicultural management scheduled include portions of MA 2.2 , MA 6.3 and all of MAs 5.x, 7.x, & 8.x. Note: Except for MA 2.2, information is based on total acreage in the MA. All even-aged and uneven-aged MAs include areas of even-aged, uneven-aged, and no active management, but they may be small proportions and are not broken out.								
Even-aged	463,900		371,900		340,100		187,800	
Uneven-aged	3,600		22,900		33,700		160,500	
No Active Management	38,900		111,700		132,700		158,200	
Silvicultural Systems Used - Estimated total acres regenerated by forest type by silvicultural system predicted Estimated cumulative acres regenerated under even-aged and uneven-aged silvicultural systems. For even-aged harvests this represents the total acres with final harvest cut between 2006 and the end of the decade shown. For uneven-aged harvests, this represents the acreage estimated to have had at least one uneven-aged entry by the end of the decade shown.								
	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6
Even-aged Management (acreage)	44,600	139,600	42,500	130,200	34,200	110,300	15,100	36,300
Uneven-aged Management (acreage)	100	100	7,300	13,800	9,900	17,100	6,000	50,600
Forest Health Measures This shows three measures of forest health risk. The first is an estimate of acres thinned over the next two decades. Thinning is a management technique to enhance tree growth and vigor. The second is estimated acreage of Northern hardwood and hemlock forest types. These forest types are most vulnerable to beech bark disease, hemlock woolly adelgid, and sugar maple decline. The third is estimated acreage of Allegheny hardwood forest type >120 years of age. These stands are more likely to experience increased mortality once they reach this age. (Acreage shown for midpoint of second and sixth decade.)								
Acres thinned in Decades 1 & 2 combined	25,100		16,900		20,000		5,100	
2005	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6
Acres of Northern hardwood and hemlock types	82,200	81,500	64,000	80,800	64,300	81,500	63,100	81,600
Acres Allegheny type > 120 yrs	900	2,000	24,800	1,800	16,700	2,700	23,800	5,200
								43,800

Table 2-3. Evaluation criteria by issue and alternative (continued)

	Alternative A	Alternative B	Alternative Cm	Alternative D					
Total acres suitable for sustainable timber production									
These lands are identified as suitable for timber production. From these acres, harvest activity may be scheduled, and harvest volume contributes to the Allowable Sale Quantity. The 1986 Forest Plan identified a suitable land base of 420,000 acres. The major reasons for change in the alternatives are reduced land area due to OGM development and identification of some lands as technically unsuitable (see Chapter 3).									
	406,600	391,700	379,100	358,200					
Forest Products - Annual Allowable Sale Quantity (ASQ) for Decades 1 & 2									
The ASQ is the maximum quantity of timber that can be sold in each decade from lands suitable for timber production. It is displayed as an annual average estimate for decades 1 & 2, expressed in millions of cubic feet (MMCF) and millions of equivalent board feet (MMBF). The 1986 ANF Forest Plan had an ASQ of 14.9 MMCF/year (94.5 MMBF/year). The 1995 “Analysis of Timber Harvest Program Capability” estimated an average annual harvest capability for 1995-2005 of 53.2 MMBF/year; with a long term potential of 77.1 MMBF/year when adequate tree seedling stocking develops. From 1986-2005, the actual volume awarded has averaged 46.4 MMBF/year, with an average award volume during the last five years (2001-2005) of 3.4 MMCF/year (20.7 MMBF/year).									
Allowable Sale Quantity Decade 1 (MMCF)	10.9	10.3	8.9	4.3					
Allowable Sale Quantity Decade 2 (MMCF)	10.9	10.3	8.9	4.3					
Allowable Sale Quantity Decade 1 (MMBF)	66.5	63.1	54.1	26.3					
Allowable Sale Quantity Decade 2 (MMBF)	66.5	63.1	54.1	26.3					
HABITAT DIVERSITY									
Percent of NF lands in three structural stages									
Three structural classes are based on the average diameter of dominant canopy trees as listed below. Uneven-aged management maintains stands in the mid-structural stage. Data is shown for the midpoint of the second and sixth decades. Note: Numbers will not add up to 100%—remainder is in non-forested or developed land condition.									
	2005	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6	Decade 2	Decade 6
Early-structural (canopy trees 0-5’’)	7%	9%	14%	9%	12%	8%	10%	4%	3%
Mid-structural (canopy trees 6-20’’)	77%	72%	48%	71%	49%	72%	48%	75%	51%
Late-structural (canopy trees >21’’)	4%	8%	24%	10%	25%	10%	28%	9%	39%

Table 2-3. Evaluation criteria by issue and alternative (continued)

		Alternative A	Alternative B	Alternative Cm	Alternative D
Percent of oak type managed by dominant silvicultural system					
Estimated percent of total amount of current oak type allocated to be managed by dominant silvicultural system. This is determined by MA from a base of 75,000 oak forest type acres. (Even-aged in MAs 1.0, 2.2, 3.0, 6.1, & 6.2; Uneven-aged in MAs 2.1; No active management in MAs 5.0, all 7.x, all 8.x, & 9.1) Note: Although MA 2.2 features a blend of uneven-aged, even-aged and no active management, oak in this MA is assigned even-aged management, and is shown that way here.					
Even-aged		77%	53%	49%	33%
Uneven-aged		0%	0%	0%	4%
No Active Management		23%	47%	51%	63%
Percent of NF lands managed for late-structural habitat					
Percent of ANF (506,500 Acres Total) allocated in MAs managed for late-structural forest (MAs 2.1, 2.2, 5.1, 5.2, 6.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.5, & 9.1). This is based on total acres allocated to these MAs whether or not they currently provide late structural forest.					
		33%	32%	40%	73%
Species viability outcomes in 2060					
The viability outcomes associated with the direct and indirect effects of alternatives for species with viability concerns do not vary appreciably among the alternatives (See Appendix E). Outcomes for the mid to late structural forest species do vary. Shown is the number of these species associated with this habitat for each viability outcome. (A: Broadly distributed, high abundance; B: Gaps in habitat, but species dispersal and interaction provided; C: Gaps in habitat cause some species isolation; D: Isolated habitat, limited population interaction; E: Habitat highly isolated, strong potential for extirpation)					
Mid to Late Structural Forest	2005				
Outcome A	0	0	0	0	0
Outcome B	8	8	8	8	8
Outcome C	4	3	3	3	4
Outcome D	7	8	8	8	7
Outcome E	0	0	0	0	0

Table 2-3. Evaluation criteria by issue and alternative (continued)

	Alternative A	Alternative B	Alternative Cm	Alternative D
Percent of interior & high-quality remote habitat remaining				
The Roads Analysis Report (2003) describes 37 areas (totaling 61,196 acres) larger than 500 acres in size without roads that are located on FS lands. High-quality remote habitat is a subset of those areas — 33,005 acres in 8 areas that had a high wildlife value. Other remote habitat displays 29 remaining areas covering 28,191 acres. The numbers shown below are the estimated percent of those lands that will not have road construction (Forest System Roads) through the end of the 6 th decade when the projected Forest Road System is completed.				
High-quality remote habitat	63%	81%	88%	88%
Other remote habitat	35%	38%	60%	60%
RECREATION AND SPECIAL AREAS MANAGEMENT				
Area of land managed for non-motorized recreation				
Estimated acreage based on allocation to MAs 5.1, 5.2, 7.2, 7.3, 8.2, 8.3, 8.5.				
	33,700	41,400	54,800	78,900
Area of land managed for ATV/OHM use				
Estimated total acreage allocated to Intensive Use Areas, where ATV/OHM use and trail development may occur.				
	99,000	113,000	83,200	40,500
Area of land managed for equestrian use				
Estimated total acreage by use class. Equestrian Use Areas are areas where horse use is limited to designated trails. Equestrian use is not limited to designated trails in areas for open riding. Restricted areas are where horse use is restricted to designated trails. Prohibited Areas are where horse use is prohibited.				
Equestrian Use Areas	0	10,600	10,600	50,000
Areas for Open Riding	506,500	470,100	456,700	0
Restricted Areas	0	18,100	31,500	0
Prohibited Areas	0	7,700	7,700	456,500
Acres recommended for Congressionally-designated wilderness study MA 5.2				
Note: Does not include existing wilderness acreage (8,979 acres)				
	0	0	12,400	30,000

2.7 Identification of the Preferred Alternative

Alternative Cm is the Preferred Alternative for revising the ANF Forest Plan. This alternative is described in detail in Chapter 2 - Section 2.4 and includes the elements common to all alternatives described in Section 2.3. The management direction, land allocation descriptions, standards and guidelines for management practices, and monitoring and evaluation plan are found in the accompanying LRMP.

2.8 Estimation of Future Oil and Gas Development

A brief estimate of future mineral development on ANF lands is listed here at the end of Chapter 2 to recognize these developments will mostly likely occur and be additive to the resource effects and outputs displayed for all alternatives. This information is summarized from Appendix F. Because reasonable foreseeable federal actions on leased minerals (870 acres) affect less than 1 percent of the ANF, they were not analyzed separately from private oil and gas development. The levels of future development shown below include both private and federal mineral development and are analyzed under the cumulative effects analysis for each resource in Chapter 3.

Surface disturbance with new well development includes approximately 0.3 acres for each well pad, and an additional 0.25 miles of new OGM roads per well, considered as private roads, pipelines and electric line corridors. The new surface disturbance figures differ slightly from the 1986 Forest Plan due to additional field information gathered after the initial Plan. An estimated 1,200 miles of private OGM roads are on ANF surface. Many new wells are also drilled off of existing Forest Roads. Operations occur across the entire forest. Recent development outside of historic known oil fields has occurred in the Hastings and Salmon Creek areas. Approximately 191,000 to 241,000 acres on the ANF are likely subject to future development, based on some expansion of the known areas developed at this time.

Table 2.4 below displays three scenarios, the historic trend, high quarter scenario, and an average projection. Over the past 20 years, an average of 225 wells were drilled on the forest each year (column 1). If oil and gas prices remain strong, it is possible that development may increase beyond that projected by historic figures. In column 2, a high quarter scenario is displayed (200 wells in 3 months occurred in 2005 when 688 wells were drilled) and considered possible to continue. Extrapolating this information to 2020 results in an estimated 11,375 wells using the historic trend approach and 20,000 wells using the high quarter scenario (see bottom rows). These estimates do not include any allowance for plugging wells. Approximately 100 to 200 wells are plugged by private operators per year on the forest. However, most of the wells being plugged are abandoned wells, not counted in the current estimate of 8,000 active wells.

The average future development scenario through the midpoint of the second decade is 512 new wells per year, the average of the 20-year average (225 wells) and the high-quarter scenario (800 wells). The rationale being that the energy market will continue to be cyclic as it has been in the past, but clearly respond to the higher demands developed over the past 2 years. This would result in an estimated 15,680 wells and 3,122 miles of private OGM roads in 2020 on national forest lands. Figures used for cumulative effects analysis in Chapter 3 will use the same development assumptions and include projections of OGM development on private lands within the boundary selected for analysis of each resource (e.g. proclamation boundary or four-county region).

Although it is impossible to predict the total number of wells that could occur on the ANF, our best estimate is that saturation would occur at 20,000 wells. This assumption is used to estimate the long term cumulative consequences of oil and gas development by the ANF in Chapter 3. The application of forestwide and management area standards and guidelines in the LRMP will limit the extent and duration of adverse environmental effects from oil and gas development.

Table 2-4. Estimated number of wells and miles of road by midpoint of second decade

Scenario	Measure						
	Existing Wells	Additional Wells	Total Wells	Existing OGM Roads (mi)	Additional OGM Roads (mi)	Total Roads (mi)	Additional Acres of Clearing
Historic Trend 1986 to 2005 (225 wells/year)	8,000	3,375	11,375	1,250	850	2,100	4,600
High Quarter (800 wells/year)	8,000	12,000	20,000	1,250	3,000	4,250	15,600
Average Future Projection (Average of High Quarter and Historic Trend: 512 wells/year)	8,000	7,680	15,680	1,250	1,920	3,120	9,980

(Note: plugging of abandoned wells would not reduce projected future active wells.)

Chapter 3

Affected Environment and Environmental Consequences



Photo courtesy of US Forest Service

This page intentionally left blank.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Changes to Chapter 3 are highlighted at the introduction to each resource.

3.1 Introduction to Affected Environment and Environmental Consequences

Chapter 3 describes the physical, biological, and social resources of the environment that may be affected by the alternatives presented in Chapter 2, as well as the effects that the alternatives may have on those resources. Affected environment and environmental effects have been combined into one chapter to give the reader a more concise and connected depiction of what the resources are and what may happen to them under the different alternatives. The environmental effects analysis forms the scientific and analytic basis for the comparison of alternatives that appears at the end of Chapter 2.

3.1.1 Relationship of Forest Plan Decisions to the Environment

The LRMP and the FEIS alternatives do not authorize implementation of management activities described in the effects analyses. The LRMP sets the stage for what future management actions are needed to achieve desired outcomes (desired conditions, goals and objectives), and provides the sideboards (standards and guidelines) under which future activities will occur in order to manage risks to biophysical resources and the social and economic environments.

To actually implement site-specific projects, project-level planning, environmental analysis, and decisions must occur. For example, the LRMP may contain direction to close or obliterate roads in order to benefit biophysical resources and to increase management efficiency, but a site-specific analysis and decision must be made for each proposal that involves any specific road closure or obliteration. This process is referred to as “staged decision-making,” because a series of decisions are necessary to carry out projects as site-specific needs, priorities, locations, conditions, and public concerns become evident.

Geographic area

Influence area

The primary zone of influence of the ANF is the four-county area of Elk, Forest, McKean, and Warren Counties, Pennsylvania. Some local influence extends into various adjacent counties of Pennsylvania and into Chautauqua, Cattaraugus, and Allegany Counties of New York. These influences are due primarily to commerce (particularly timber, minerals, and construction), recreation, and relationships with the Seneca Nation of Indians, Allegany State Park in New York, and Cook Forest State Park in Clarion County, Pennsylvania. Regional influence extends to the Pittsburgh area and to the Youngstown-Cleveland area in Ohio.

Immediate forest

The ANF is located in northwestern Pennsylvania with relatively comparable acreage in Elk, Forest, Warren, and McKean Counties. The Forest contains approximately 506,475 acres of land and 10,370 acres of surface water in the Allegheny River and Reservoir. The Legal Proclamation Boundary encompasses approximately 751,400 acres, including the reservoir and river. See Preface for a more general overview description of the forest.

Time period described

The forest planning cycle is considered to be 10 to 15 years. However, the forest plan is expected to be updated as necessary through amendments to keep its strategic function in step with the best available science. Modeling of forest vegetation changes was carried out for 150 years from approximately 2005.

For this analysis, activities are described in terms of the average annual amount expected to occur by decade or decadal totals. When conditions on the ground are described, they are usually described for the midpoints of the decade. The midpoint of the first decade may be referred to as 2010, the midpoint of the second decade as 2020, and the midpoint of the sixth decade as 2060 to reference these conditions. Short-term effects generally speak to effects within the first or second decade. Long-term effects analyzed by alternative focus on the sixth decade from the present.

Overview of chapter

The remainder of Chapter 3 is organized by resource, focusing on those resources that are related to major issues described in Chapter 1. Each resource section is organized and presented in the format described below.

Affected environment

Describes the current conditions of the resources related to the issues. This section may also include history, development, past disturbances, natural events, and interactions that have helped shape the current conditions. Recent trends are described to aid in understanding the current conditions.

Environmental consequences

Scope of the analysis – Briefly describes the geographic area or areas affected for the resource-related issues. Areas may differ for direct, indirect, and cumulative effects. Affected areas may also vary in size depending on the resource, issue, or anticipated activities. This section also describes the time frame over which effects are assessed.

Introduction to effects – Describes the general type of effects that may occur to the resource from implementation of the alternatives, including any mitigating effects from resource protection methods. This section also identifies activities that might vary by alternative, but the variation is so small as to have negligible difference in effects across alternatives.

Effects common to all alternatives – Lists activities, design criteria, or uses that do not vary by alternative.

Direct and indirect effects – Analyzes the amount and intensity of direct and indirect effects by alternative on the resource-related issues and environmental elements. Direct effects are caused by an action and

occur at the same time and place as that action. Indirect effects are caused by an action but occur later in time or farther removed in distance. This section also looks at the relationship of temporary, short-term, and long-term effects. This section discusses effects that vary by order of magnitude across alternatives. Direct and indirect effects are focused on Federal actions.

In the analysis included throughout Chapter 3, the numbers for management activities (e.g. road miles, acres of timber harvest, level of uses) are all best estimates based on the latest available information listed in Chapter 2. The analyses conducted for the FEIS are intended and designed to indicate relative differences between the alternatives, rather than to predict absolute amounts of activities, outputs, or effects.

Cumulative effects – Analyzes the cumulative effects to the resource that may result from the incremental impacts of the alternatives when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions.

3.2 Physical Environment: Direct, Indirect, and Cumulative Effects

3.2.1 Geology and Minerals

The following changes have been made between draft and final: Table 3-1 was expanded and updated to include one new federal lease, and to support the data presented in Table 3-2 (new). Paragraphs discussing the new Table were also added. A section on potential acquisition of private minerals has been added consistent with new land acquisition objectives in the LRMP. The cumulative effects statement regarding Federal minerals was also updated to reflect one new lease that will be producing.

Affected environment

Geology

The ANF is located in the Northern Unglaciaded Allegheny Plateau Section of the Appalachian Plateau Geomorphic Province (Bailey 1980). It is a maturely-dissected plateau, characterized by sharper ridgetops and narrower valleys than the glaciaded portions of the plateau just to the north and west. Drainage is dendritic. Mass wasting, fluvial erosion, and transport deposition are the primary geomorphic processes. Broad, low amplitude, NE-SW trending folds tilt the horizontally-bedded sedimentary layers approximately 6°, and lend a subtle grain to the topography.

A veneer of unconsolidated materials overlay bedrock: residuum of flat and gently sloping uplands, colluvium at the base of steep hillsides, and alluvium in narrow valley bottoms. Thicker deposits of clay, silt, sand, and gravel are present in wider valleys. Beneath these sediments, the upper Devonian, lower Mississippian, and Pennsylvania bedrock is composed of a mixed siliciclastic sequence of sandstone, siltstone, shale, subordinate conglomerate, occasional limestone, and coal.

Energy minerals

In 1859 Colonel Drake struck oil on Oil Creek in Venango County, which is about 15 air miles southwest of the forest. This strike started the worldwide commercial oil industry. Rapid development followed, and radiated northeast across the Allegheny Plateau, much of which was in corporate ownership by large timber companies. During this period, developers purchased oil and gas rights from private land owners, and began development. Some leases, particularly on the southwest corner of the ANF, date from the 1880s.

In 1923, following passage of the 1911 Weeks Act, a determination was made by the Forest Service that national forest objectives could be achieved with the mineral rights separated from the surface. Consequently, under most of the surface land acquired for the ANF, the subsurface rights are privately owned, either by a third party (outstanding rights), or reserved (reserved rights) by the seller.

Ownership

Seven percent, or about 35,000 acres, of the subsurface mineral estate is federally owned (Table 3-1). Of this total, 16,254 acres, or 46 percent, have been withdrawn from leasing. An additional 7,315 acres are unavailable for leasing. These areas include lands inundated by the Allegheny Reservoir. The following areas have Federal minerals withdrawn: Tionesta Research Natural Area (future development only), Hickory Creek Wilderness, Allegheny Islands Wilderness, and Hearts Content Scenic Area.

Presently, four areas of Federal minerals are leased, totaling 870 acres. A leasable mineral is one that is owned by the Federal Government, and leased by a private individual or corporation through the Bureau of Land Management (BLM) lease process. The BLM oversees all Federal mineral leases. While there are currently four federally-owned mineral leases on the ANF, they are not producing oil or gas at this time. See Appendix F, Figure 1 for areas of Federal minerals.

Table 3-1. ANF mineral ownership and status

Source: Land status atlas (varies from GIS acreage)

Status	Acres
Federal minerals	
Withdrawn (Hickory Creek and Allegheny River Islands Wilderness Areas and National Recreation Areas)	16,254
Not available (under Reservoir)	7,315
Mineral ownership only (surface owned by third party)	4,297
Leased (4 current leases)	870
Available for lease	6,267
Total Federal minerals	34,973
Outstanding and Reserved Ownership	478,283
Total Acres (rounded to nearest whole acre)	513,256

Development and trends

Between 1986 and 2005, approximately 4,493 new wells have been drilled on ANF surface; an average of 225 new wells per year for the 20-year period. On an annual basis, the number of new wells ranges between 68 in 1996 and 688 in 2005. The total number of old wells that have been plugged is unknown. At present, an estimated 8,000 oil and gas wells are in production. Due to the nature of the oil/gas bearing sands drilled, wells can remain in production for 25 to 30 years. The number of wells drilled on the ANF annually is cyclic, and is driven by the price of oil and natural gas on the local and regional markets. When oil prices are high, the number of new wells drilled is also constrained by the availability of drill rigs, service equipment, and personnel in the private sector. Based on data reported since the 1986 Forest Plan, roughly 153 old wells are plugged each year (see Appendix F). See Appendix F, Figure 3 for location of new wells drilled since 1986.

For each new well drilled, approximately 0.3 acres are cleared for each well pad, one acre is cleared for roads (0.25 mile x 35 foot clearing width), and 0.75 abandoned wells are plugged. Gathering pipelines are generally buried within the width of the road clearing. The lines may feed into a larger distribution line, or may be connected to a tank battery, which is a series of oil and brine storage tanks. Most people are unaware of natural gas storage pools, as the pools are underground at depths of 2,000 to 8,000 feet. Surface indicators of gas storage areas are compressor stations, meters, and pipelines. An estimated 1,200 miles of private oil and gas roads are on ANF surface. Many new wells are also drilled off of existing FS roads.

All of the wells currently in operation on the ANF are “shallow” wells. By definition, a shallow well does not penetrate the boundary between the Middle and Upper Devonian Series, or the top of the Tully Limestone or its equivalent in Pennsylvania. This generally equates to well depths of between 500 and 5,000 feet. A “deep” well penetrates the boundary. Important source rocks for shallow oil and natural gas production include the Venango and Bradford Groups, and for deep reserves, the Onondaga, Oriskany, and Medina Groups. See Appendix F, Figure 2 which shows known oil and gas fields underlying the ANF.

Some geologists project that there are deep (10,000 to 20,000 feet) oil and gas deposits in the Appalachian Basin, which includes the area of the ANF. To date, the existence of these reserves has not been proven; although a handful of deep wells have been drilled. If deep deposits are located and developed a new oil boom for the Allegheny Plateau could follow.

Coal

Pennsylvania is located at the northeastern end of the Appalachian Coal Basin. The ANF is at the extreme northern part of the Main Bituminous Coal Field, with sporadic and thin coal beds underlying the surface. The coals underlying the forest are considered low-rank high-volatile bituminous, meaning that they contain less than 69 percent fixed carbon. In contrast, the high-rank anthracite beds of eastern Pennsylvania contain up to 98 percent fixed carbon content. Thick beds of high-rank coal are much preferred, and more economical to mine than the lower quality, thin beds located under the ANF. Of the four counties which comprise the ANF, only Elk produced coal in 2002, the most recent year that Pennsylvania coal data is currently available. None of that production was on the ANF.

Material minerals

Common variety minerals present on the ANF include unconsolidated sand and gravel deposits, and pit run stone. No commercial sand or gravel pits are in use on ANF land (See transportation section for effects from gravel pits).

Direct and indirect effects

From a high of nearly 5,000 acres leased in the early 1990s, interest in Federal mineral leasing has steadily declined. Currently, four areas, totaling 870 acres, are under lease. None of the leases are currently producing oil or gas, but one leaseholder is beginning the process of developing his lease.

Due to the long leasing process, which may take years, and the availability of private minerals both on and off the forest, leasing is not a particularly attractive option for potential developers. If new reserves are discovered, and energy prices remain high, it is possible that interest in leasing Federal minerals on the ANF may increase. The small amount of direct and indirect effects of Federal mineral development will not be handled separately by resource, but cumulatively with the private minerals.

Table 3-2 shows the availability of Federal minerals for lease by alternative. The LRMP amount of 27,658 acres of Federal mineral ownership excludes acres which lie under the Allegheny Reservoir. The remaining 93 percent (478,283 acres) of the ANF subsurface mineral estate is privately owned (source: lands status atlas; varies from GIS acres).

Of the acres available for leasing under all alternatives, the following management areas have limited surface occupancy, unless withdrawn or within 1,300 feet of Allegheny Reservoir: MAs 1.0, 2.1, 2.2, 3.0, and 6.1. In Alternative A, MAs 6.2, 8.6, and 8.4 allow limited surface occupancy. MAs 7.1 and 8.3 do not allow surface occupancy. No areas are considered to be unavailable.

In Alternatives B, Cm, and D:

- Unless withdrawn or not available, all areas within 1,300 feet of the Allegheny reservoir and MAs 7.2 and 8.6 do not allow surface occupancy
- MAs 5.2, 7.1, 8.1, 8.3, 8.4, and 8.5 are not available for leasing under the LRMP
- MAs 5.1, 8.2, and 8.5 are withdrawn

See Appendix F, for specific information on lease occupancy stipulations.

Table 3-2. ANF Federal minerals (stipulations by alternative) acres

Source: Land status atlas (varies from GIS acreage)

Occupancy Type	Alternative A	Alternative B	Alternative Cm	Alternative D
Limited surface occupancy	9,394	8,623	8,429	7,614
No surface occupancy	2,010	1,843	1,846	2,658
Withdrawn	16,254	16,254	16,254	16,254
Not available	0	936	1,132	1,132
Acres	27,658	27,656*	27,658	27,658

* rounding error

Potential for Federal mineral acquisition

There are objectives in the LRMP to acquire private minerals in certain management areas (MAs 5.2, 7.1, 8.1, 8.2, 8.3, 8.4, and 8.5). The amount of land varies by alternative. If successful, this acquisition could reduce the potential for oil and gas development. If these mineral rights are successfully acquired, the following are new totals for the land area of the ANF that would not be available or would be withdrawn from mineral development (this includes the acreage shown in Table 3-2):

- Alternative A 32,000 acres
- Alternative B 45,000 acres
- Alternative Cm 57,000 acres
- Alternative D 59,000 acres

Cumulative effects

Because reasonable foreseeable federal actions on leased minerals (870 acres) affect less than 1 percent of the ANF, they were not analyzed separately from private oil and gas development. See Section 2.8 for projections of future mineral development on the ANF. Each resource section uses the projections in Section 2.8 to consider cumulative effects on the ANF surface from mineral development.

3.2.2 Soil Resources

In response to comments on the DEIS, this section contains additional information to clarify effects of soil acidification, prescribed burning and scarification on soil resources.

Affected environment

According to Jenny (1994):

Soil is a natural body, differentiated into horizons of mineral and organic constituents, usually unconsolidated, of variable depth, which differs from the parent material below in morphology, physical properties and constitution, chemical properties and composition, and biological characteristics. (p.1)

Soil is an integral part of the ecosystem and serves many roles: a medium for plant growth, a regulator for water supplies, habitat for organisms, an engineering medium, and an environmental interface (Brady and Weil 2002, p.2-3). Even President Franklin Delano Roosevelt once said, “The nation that destroys its soil, destroys itself.”

Soil formation is the result of an integrated set of factors that includes parent material, time, topography, climate, and biota (Jenny 1994, p.14-15). Parent materials influence the physical and chemical characteristics of the soils that develop (Brady and Weil 2002, p.40). Soils on the ANF are formed from parent materials of sandstone, shale, siltstone, conglomerate, mudstone, and small quantities of coal and limestone formed during the Devonian, Mississippian, and Pennsylvanian periods 290 to 405 million years ago (Berg, Geyer, Edmunds *et al.* 1980,

Bureau of Topographic and Geologic Survey 2000 (map 7)). Soils form as these parent materials weather over time. Large-scale disturbance events such as glaciations restart the soil forming process as they pass over an area. Even though recent glaciation came close, most soils on the ANF were not glaciated during the Wisconsinan, Late Illinoian, or prior to the Pre-Illinoian periods. Consequently, most of the soils on the ANF have been forming for more than 770,000 years.

Climate influences the nature of soil weathering and consequently soil formation. Precipitation on the Northwestern Allegheny Plateau ranges from 40 to 50 inches per year, including 50 to 100 inches of snowfall, and is evenly distributed throughout the year (McNab and Avers 1994, p.14-10). The average winter temperature is 21 degrees Fahrenheit and the average summer temperature is 64 degrees Fahrenheit. During glacial periods, areas that were not covered by glacial activity experienced a periglacial climate where soil was frozen to some depth throughout the year (permafrost). These conditions resulted in increasing specialized erosion processes associated with freeze/thaw cycles and changes in biota that influence soil development in the area (Sevon and Fleeger 1999, p.25-28).

Topography influences soil formation by interacting with other factors to either hasten or retard soil formation. The ANF is composed of plateau tops with elevations up to approximately 2,300 feet and valleys down to approximately 1,000 feet above sea level. Slopes range from less than 5 percent to over 60 percent. Over geologic time the steeper slopes have greater natural erosion rates and a higher degree of mass movement (Brady and Weil 2002, p.61-62).

Finally, living organisms enhance the soil forming processes through profile mixing, organic matter accumulation, nutrient cycling and protection from erosion (Brady and Weil 2002). Plants, animals, and the changes in their communities enhance soil formation on the ANF. A description of plants and animals on the ANF can be found in the vegetation and wildlife sections.

Soil quality is the inherent capacity of a specific soil, as determined by its inherent physical, chemical and biological characteristics, to perform its biologic, hydrologic, and other ecological functions. The elements of soil quality that are primarily affected by land management activities on the ANF are soil nutrient status, soil erosion and soil compaction.

Soil nutrients

There is a concern that forest management activities can cause the loss of some nutrients, i.e., base cations, from the soil. Soils in the ANF are typically lacking in base cations, primarily calcium and magnesium, due to the rarity of high base status geologies (i.e., limestone, dolomite) in the area. Additionally, most of the ANF was not glaciated so the soils are old and highly weathered. Acid deposition, also called acid rain, is prevalent on the ANF, and since soils across the ANF have a low buffering capacity, they are highly susceptible to becoming even more acidic. Acid deposition falls to the ground as sulfuric and nitric acids. These acids enter the soil displacing base cations, primarily calcium and magnesium, and eventually aluminum is released into the soil solution. This process acidifies the soil. Acidification of soils increases cation leaching, decreases soil pH and base saturation, and negatively affects many biological processes (Adams and Kochenderfer 1998, p.119-120).

Biogeochemical modeling reveals that atmospheric deposition, especially sulfate, had the greatest effect on estimated soil calcium loss, while timber harvesting led to only a slight decrease in exchangeable soil calcium (Gbondo-Tugbawa and Driscoll 2003, p.182)

A recent study comparing soil nutrients of archived soil samples from 1967 and samples collected between 1997 and 1999 indicates that soils in and around the ANF have become more acid and there has been a significant reduction in base cations over the 30 year time frame (Bailey, Horsley and Long 2005, p.689). These reduced levels of base cations are evident on plateau, shoulder, and upper backslope landforms. Plateau and shoulder landforms represent approximately 28 percent of the area within the proclamation boundary of the ANF and are most susceptible to the loss of base cations through acid deposition and other factors. It is difficult to assess the area in the upper backslope landform, but it is likely in the range of 10 to 13 percent of the area within the proclamation boundary of the ANF. Lower backslopes, toeslopes, terraces, and floodplains are believed to have higher levels of base cations due to additions of these elements from water filtering through higher base status geologic layers and coming to the surface in ground water, seeps, and springs (Swistock *et al.* 1999 p.70). The additional nutrient and chemical input from the geology can reduce the acidity of the subsequent surface water. Due to higher levels of base cations, these lower landforms often support different vegetation, such as sugar maple, white ash, and basswood, than the plateau and upper landforms. See additional discussion in Forest Vegetation section.

Soil erosion

There is a concern that land management activities can cause soil erosion, which reduces soil productivity and adds sediment to local waterways. Erosion of topsoil can have broad and long lasting effects on soil quality. Erosion is a natural process (Dunne and Leopold 1978, p.510), but some types of land management can either accelerate the rate or change the type of erosion.

Susceptibility to soil erosion is controlled by soil texture, slope gradient, length of slope, precipitation, and soil cover (e.g. vegetation, duff, and rock). Barring disturbance, soil erosion is limited by rainfall interception in the vegetation canopy, duff layers of leaves and other organic matter that greatly reduce the effects of raindrop impact on mineral soil particles. County soil surveys have developed erosion hazard ratings for each soil map unit based on soil texture, percent rock, and slope gradient. Soil erosion hazard rating is listed in the soil survey interpretations for both off-road erosion and on-road and trail erosion. This is done because roads and trails have heavily compacted areas with less ground cover making them much more susceptible to erosion than off-road areas, especially in a forested environment. For the off-road/trail erosion soil interpretation approximately 19 percent of the ANF has a severe or very severe rating. For the on-road/trail erosion soil interpretation, the area of the ANF with severe or very severe rating increases to about 51 percent.

Soil mass movement is rare on the ANF typically occurring after large rain events and land management activities (Eschner and Patric 1982, p.345; Pomeroy 1981, 1986, p.9; Schultz 1999, p.771). The primary areas of concern for future soil mass movement are on historic landslides and colluvial soils formed on a surface geology of shale. Colluvial soils are formed from material deposited at the foot of a slope usually eroded and moved downslope by gravity. Colluvial soils are found on about 18 percent of the area within the proclamation boundary.

Soil compaction, puddling and rutting

There is a concern that traffic from heavy equipment, ATV/OHMs and dispersed equestrian use will cause compaction, puddling and rutting leading to increased erosion and runoff.

Soil compaction is defined as an increase in soil density (weight per unit volume) and strength that hampers root growth, reduces soil aeration and inhibits soil water movement. Puddling is an alteration of the soil structure severe enough to reduce the permeability and infiltration rate of the soil. Rutting is a severe form of soil puddling. Detrimental ruts are typically at least 6 inches deep and 10 feet long (USDA FS 2005a, p.11).

Compaction, puddling, and rutting susceptibility depend on the soil texture, soil moisture, and rock content of the soil (Alexander and Poff 1985, p.3). Soil texture on the ANF ranges from silt loams to sandy loams which are relatively to somewhat susceptible to compaction, respectively (Brady and Weil 2002, p.136-140). Within the proclamation boundary, approximately 9 percent of the soils are poorly drained and another 45 percent are moderately well drained. Both of these classifications indicate a high risk of compaction due to the amount of time the soil is wet. Poorly-drained to moderately well-drained soils can be operated on when dry to avoid compaction, rutting, and puddling. However, even well drained soils are susceptible to compaction, especially during rainy periods. Adherence to FS Eastern Region soil quality standards (USDA FS 2005a) assumes that long-term losses in inherent soil productivity and function will be prevented.

Direct and indirect effects

Scope of analysis

The analysis area for direct and indirect effects includes all federal lands administered by the ANF. This is the area potentially subject to soil disturbance as a result of Federal land management activities and uses implemented under the LRMP.

The analysis area for cumulative effects will also include the private land within the proclamation boundary of the ANF. Generally, effects of FS activities and uses on FS lands do not extend to adjacent lands and vice versa, but landscape-level impacts are important to assess. The potential for sediment to leave ANF administered lands via the stream system is covered in the water resources section. For soil erosion and compaction, the cumulative effects analysis will be bound by the timeframe from the adoption of the 1986 Forest Plan until the next revision of the forest plan, approximately 2020. For soil nutrients, the cumulative effects analysis will be bound by the timeframe from 1967 until approximately 2020. The beginning year was chosen because it was the collection date of the soil samples used as the baseline soil nutrient data in a recent study on the changes in base cations in soils on the ANF (Bailey, Horsley and Long 2005). Pollution source areas well beyond the ANF boundaries will be discussed relative to soil nutrients in order to show the far-reaching nature of acid deposition effects on soil nutrients, but effects on soil nutrients will remain focused on the land within the proclamation boundary.

Introduction to Effects

Soil nutrients

Harvest methods affect the nutrient cycle of the forest floor differently (Elliott and Knoepp 2005, p.314). Methods that remove excess organic material (such as whole-tree harvesting) have more of an effect on nutrient availability than methods like stem-only, that leave organic material (branches, leaves, tree crowns) at the harvest site (Elliott and Knoepp 2005 p.297). Short harvest rotations also have shown decreases in soil base cations due to the lower accumulation of organic matter and higher soil disturbance (Grigal 2000 p.175). Likewise, soil-disturbing activities, including skidding and log yarding, decrease soil productivity to a minor degree by removing soil organic matter and compacting the soil (Berger *et al.* 2004 p.2163).

On average, about half of the nutrients stored in a tree are contained in the traditionally unmerchantable tops (Powers *et al.* 1990, p.60). Where only the stem wood is removed, as is standard practice on the ANF, about half of the nutrients in trees are left on site to be recycled. Whole-tree harvesting which does not retain tree tops on site has not been shown to cause depletion of exchangeable base cations in experimental work at Hubbard Brook Experimental Forest in New Hampshire (Johnson, Romanowicz and Siccama 1997, p.867) and at the Walker Branch Watershed in Tennessee (Johnson and Todd 1998, p.1734). Additionally, depletion of soil base cations did not occur following stem-wood-only harvests at the Coweeta Hydrologic Laboratory in North Carolina (Knoepp and Swank 1997, p.6). Treetops that remain after stem removal store nutrients, releasing them slowly over time. Whole-tree harvesting does not occur on the ANF; tops and limbs are left on site. The influences of vegetation management on base cation dynamics on the Allegheny Plateau are, as yet, not fully understood, but scientific research is ongoing and previous research (cited above) indicates that additional base cation depletion did not occur following site changes from timber extraction even more dramatic than those proposed on the ANF.

While fallen branches and slash left after timber harvest are very useful in recycling nutrients and organic matter back to the soil, the main stems of dead trees that have fallen to the ground decompose much slower and provide these same benefits for a much longer time period (Maser and Trappe 1984, p.1). Down trees and tops are known as down woody debris and exist in all life stages of a forest, but are usually more prevalent in older mature units. Down woody debris provides habitat for many species of fungi, bacteria, insects, and animals that in turn provide nutrients, organic matter, and other benefits to the soil (Maser and Trappe 1984, p.19-36). Down woody debris accumulates with time as trees die through natural thinning due to a lack of adequate resources, blowdown, insects or disease. Forestry practices disrupt the natural accumulation of down woody debris. Uneven-aged management enters a stand approximately every 20 years and removes trees that will otherwise die and contribute to down woody debris. Thinning in even-aged management does the same thing, but using a different time frame (see LRMP Appendix A). Salvage, for both sanitation and mortality, also harvests and utilizes down woody debris that will otherwise be incorporated into the soil nutrients. Down woody debris on the ANF is highest in areas greater than 110 years of age and in areas between 11 and 50 years of age (i.e., recently harvested areas where treetops are left on site) (Morin *et al.* 2001, p.37).

Following fertilization, where the majority of the large overstory trees have been harvested, nitrogen-demanding species (e.g. pin cherry, black cherry, raspberries and blackberries) with shallow roots are positioned to take up excess nitrogen with minimal losses off-site (Marks 1974, p.86). Rapid uptake by these plants limits the increase of nitrogen and associated nutrients in the soil, preventing leaching loss. This uptake and utilization of nitrogen indicates that the plants on site can consume added nitrogen in fertilizer, indicating that soils of the ANF are not nitrogen saturated (Peterjohn, Adams and Gilliam 1996, p.516). However, it is assumed that some nitrogen in the fertilizer attaches to base cations (e.g. calcium and magnesium) in the soil and moves down through the soil profile transporting the base cations out of the rooting zone, making the nutrients unavailable to the tree species that require them (e.g. sugar maple, basswood and white ash). Fertilization is applied for the regeneration of a few even-aged species. Therefore, areas where even-aged management is promoted will be most susceptible to the affects of fertilization on soil nutrients.

Use of herbicide increases light level on the ground and affects soil nutrient and water resource availability to regenerating vegetation by eliminating competing species. The typical half-life of glyphosate herbicide in soils on the ANF is approximately 60 days (Appendix G1, p. G1-42). Glyphosate herbicide binds readily to soils becoming relatively immobile, so there is limited potential for residual effects or effects to soil nutrients. It then breaks down completely and rapidly to aminomethyl phosphonic acid, which is more stable than glyphosate. Decomposition end products include carbon dioxide, water nitrogen and phosphate. The half-life is longer in sandy soils and shorter in silt loam soils, the two most common textures found on the ANF.

Sulfometuron methyl herbicide is more mobile in soil than glyphosate, but has a short half-life in acidic soils, such as those found on the ANF. Sulfometuron methyl is also strongly adsorbed to soil particles at low pH (acidic conditions) and at high organic matter contents; therefore, little soil mobility is expected. Nonetheless, it is listed as “inhibitory” for some soil fungi and bacteria. Sulfometuron methyl is broken down by water and microorganisms. It can breakdown in a few days to several weeks depending on soil and air temperatures, but based on average soil conditions found on the ANF the half life is expected to be less than 3 weeks. Principle products of the breakdown of sulfometuron methyl include saccharin, carbon dioxide and methyl 2-(aminosulfonyl) benzoate (Appendix G1, pages G1-104, G2-42). Schreffler and Sharpe (2003, p.480-481) indicate that sulfometuron methyl applied after timber harvest slightly acidifies soil but the results are not statistically significant. While soil acidification is a concern, no other studies have indicated that sulfometuron methyl has a side effect of soil acidification.

Excessive herbicide use above the normal rates used in forestry applications can inhibit soil microorganisms, but when used at normal rates both glyphosate and sulfometuron methyl do not significantly reduce the activity of soil microorganisms. The effects of sulfometuron methyl on soil microorganisms has not been researched as well as the effects of glyphosate, but it still appears that it does not significantly reduce activity of soil biota at typical rates (Appendix G2, pg. G2-42). At the application rates, both typical and maximum planned for the ANF, neither sulfometuron methyl nor glyphosate should significantly reduce the activity of soil microorganisms nor adversely affect them in such a way as to reduce site or soil productivity.

Prescribed burning may also have an effect on soil nutrients. Low-intensity prescribed burns, like those done on the ANF, will likely increase soil pH as well as available calcium and magnesium in the short term (Arocena and Opio 2003, p.12). However, carbon and nitrogen in the soil will decrease due to combustion of organic matter (Neary, Klopatek, DeBano and Ffolliott, 1999, p.62). Detrimental soil effects are directly related to the severity of the fire. If prescribed burn plans are followed and low-intensity burns occur as planned, then the effects will be minimal and temporary.

Soil erosion

Soil erosion can have a direct effect on soil productivity through the loss of nutrients, organic matter, and fine-textured soil particles. These three elements play a major role in soil quality and productivity.

Timber harvest can affect erosion potential by removing the vegetation and organic matter that protects the soil surface from raindrop impact. Harvest equipment can compact the soil, reducing soil porosity and infiltration rates, thereby increasing runoff and erosion. Severe rutting can concentrate sheet flows into rills and gullies, thereby increasing the erosion potential of the water moving across the soil. Soil erosion is generally low in the forested environment due to continual inputs of duff and organic matter from leaf fall. In a managed forest, erosion remains low due to the relatively long time between treatment activities. Harvest on slight-erosion-potential soils usually does not cause accelerated soil erosion. Stands on slopes greater than 40 percent are not suitable for timber harvest due to the high risk of accelerated erosion and damage from ground-based logging equipment. The potential for accelerated erosion from timber harvest will be assessed by comparing the potential for harvest (even-aged or uneven-aged) on soil map units classified as severe to very severe for off road/trail soil erosion potential between each alternative.

Road decommissioning can help reduce erosion from roads. Decommissioning may involve removing the roadbed and recontouring the road prism. A decommissioned road can, through time, regain some productivity. The soil under and within a decommissioned road prism will exhibit qualities of a manmade soil for several decades, but will have improved drainage, allow subsurface flow, and support plant life. The actual decommissioning will likely cause short-term increases in erosion, but in the long-term, erosion will be reduced.

Road construction and use can cause accelerated erosion levels by changing rainfall impact on road and soil surfaces and surface runoff on roadbeds. Road maintenance can cause temporary increases in erosion and sedimentation, but it will typically reduce erosion over the long-term. Mitigations such as improved drainage and more resistant surfacing can reduce the amount of road-related erosion or at least reduce sedimentation in nearby waterways (Weaver, Hagans and Popenoe 1995, p.120). The changes in runoff, drainage, and weight on a hillside can effect slope stability and change an area's susceptibility to mass movement, such as landslides during very wet weather. Estimated levels of new road construction will be compared by alternative to assess the effects on soil erosion. Management areas that prohibit road construction will obviously not contribute to road-related soil erosion.

Trail construction and use has similar effects on erosion as road construction and use, but at a smaller scale. Most ATV and OHM trails are surfaced with sandstone or limestone materials which help to reduce erosion. Limestone reduces erosion much more than the sandstone material because limestone does not

break down as quickly as sandstone under vehicle traffic. User-created horse trails are typically not surfaced and have few to no mitigations built into the trail to limit erosion or subsequent sedimentation to nearby streams. Designed horse trails, however, are intended to have surfacing near stream crossings to help limit sedimentation. Designed horse trails also contain other mitigations to help reduce erosion from trail construction and use. Designed hiking trails also typically have no surfacing to reduce erosion, but they usually have some mitigation to help reduce erosion and sedimentation. There are currently no bicycle trails on the ANF and bicycle and hiking trail construction potential does not vary by alternative.

Prescribed fire can also effect soil erosion. Fires typically remove the duff layer from the soil, therefore exposing the soil to raindrop impact and soil erosion. The effect is short-term and only last until revegetation occurs. Mass movement susceptibility is also increased by fire (Neary, Ryan and DeBano 2005, p.44). Detrimental soil effects are directly related to the severity of the fire. If prescribed burn plans are followed and low-intensity burns occur as planned, then the effects will be minimal and temporary.

Ground scarification is used to promote oak and aspen regeneration on the forest. Scarification for oak involves a small dozer with a root rake. The scarification usually takes place after acorn fall but during leaf fall. Soil is exposed in the process but is quickly covered by the leaves. The leaves act as protection for the soil from raindrop impact which prevents erosion. Sensitive areas like drainages and steep slopes are avoided. Scarification for aspen occurs during the winter. Therefore, the scarification methods used on the forest will typically not cause detrimental soil erosion.

Soil compaction, puddling and rutting

Ground-based harvesting or salvaging of timber using heavy equipment can cause compaction. The extent and severity of compaction depends on the weight, surface area to which that weight is applied, number of passes, soil texture, soil moisture, and rock content of the soil (Alexander and Poff 1985, p.76-78, Liechty *et al.* 2002, p.44-45). Soil porosity has been identified as one of the keys to maintaining forest soil productivity. Heavy harvesting equipment, ATV, OHM, and horses can compact soils, resulting in a loss of soil porosity. Some soils have high water tables or fine textures that will not support equipment or horses unless the soil is dry or frozen. Other soils have impermeable layers (fragipans) at relatively shallow depths that restrict water movement and cause the soil to remain moist well into the summer. The retention of soil moisture in these soils increases the soils' susceptibility to compaction, rutting, or puddling.

Vegetation treatments have varying extents of associated compaction assuming ground-based activities are used to harvest the timber. Typically, the more timber removed and the more entries into a stand, the greater the extent and severity of detrimental soil compaction. Though only one pass over a given area is usually taken, heavy equipment used to apply fertilizer or herbicides can also have minor, cumulative impacts on soil compaction. Fencing of a stand creates an approximately 10-foot-wide disturbed area that will likely have moderate levels of compaction. The extent and amount of compaction also depends on factors such as whether the soil is frozen at the time of the activity, or the amount of slash lying on the skid trail. Scarification methods used on the forest may cause slight soil compaction. For oak scarification, the root rake following the dozer essentially rips or loosens the soil immediately after compaction. Aspen scarification is performed in the winter when the soil is typically frozen and compaction resistant. Therefore compaction from scarification should be slight.

Roads and designated trails are long-term areas of very dense “extreme” compaction. As opposed to compaction that occurs as a result of vegetation treatments, compaction in road and trail beds is intended, and in fact beneficial, for the use and maintenance of the road/trail. The compaction helps to make the areas more stable for the user, but the compaction does limit plant growth, water infiltration, and soil aeration. Compacted areas contribute more runoff to streams and more soil is eroded from the compacted and adjacent areas. User-created trails may be compacted as much as designated trails but they are typically not used long-term and are across a greater extent of a given area. This is due to a tendency on the part of the user to just move to a new area as one trail is blocked or becomes impassable. A lone pass over an area by a horse will only cause very minor levels of compaction and if not walked over again will be inconsequential. It is the tendency of others to follow behind that result in user-created horse trails.

Forest Service Eastern Region directives (USDA FS 2005a) address detrimental soil disturbance: compaction, displacement, puddling/rutting, burning, erosion, and mass movement. The combination of these conditions is limited to 15 percent of the activity area. Rutting is limited to 5 percent of the activity area, included in the 15 percent disturbance. Activity areas are areas of potential soil disturbance that will be expected to produce biomass in the future. Compaction is the main concern for the ANF as it has been seen to cause the highest amount of detrimental soil disturbance, but activities rarely cause the disturbance to exceed 15 percent. Any disturbance above the 15 percent threshold is addressed with corrective actions by the ANF.

Effects common to all alternatives

The potential for construction of new bicycle and hiking trails is the same for all alternatives. Therefore the associated soil erosion and compaction associated with development of these trail types remains the same for each alternative. Also, the potential for pit expansion and new pit construction is estimated to be the same for all alternatives. The estimated level of average annual road decommissioning will also be nearly the same for each alternative, so the benefits to the soil resource from this activity will be the same for all alternatives.

Effects from each alternative

Soil nutrients

Alternative A

Currently the ANF has a policy that limits whole-tree harvesting. This policy helps to maintain slash which contains approximately half of the nutrients in trees. However, the policy is not in the 1986 Forest Plan, so there is a risk that it will not be implemented over the course of the planning horizon. There is no direction for retention of large down woody debris.

There are approximately 118,000 acres (23% of ANF land) in the landbase suitable for timber harvest on the plateau and shoulder landform (the upper backslope landform was not broken out in the ecological landtype mapping). This area is at greater risk for loss of base cations through removal of base cations stored in stem wood even though stem wood only contains approximately half of the nutrients in a tree. Of this area approximately 111,000 acres (22%) are primarily managed for using even-aged management (MAs 1.0, 3.0, and 6.2) and have potential for nitrogen-based fertilization as a regeneration tool. Nitrogen fertilization exhibits the risk to

increase the leaching of base cations out of the soil. Base cations are important macronutrients to many tree species, especially sugar maple, basswood, and white ash. The potential for use of nitrogen-based fertilizer for regeneration is greatest in Alternative A (Table 2-2).

There is policy but no direction for salvage of topsoil prior to pit development or building construction. Salvaged topsoil can retain many of the nutrients depending on the length of time stored prior to reclamation or adjacent use of the material. Construction of roads, pits, and buildings causes a long-term change to soil structure and nutrient holding capabilities. Under Alternative A there is the potential for approximately 3,400 acres to be “buried” and have soil nutrient processes limited by existing FS roads and potential new FS road construction.

Alternatives B, Cm, and D

Limits on whole-tree harvesting and guidelines to leave slash scattered throughout a unit are included in design criteria for Alternatives B, Cm, and D to help maintain soil nutrients in harvest units through the planning horizon. Additionally, there is a guideline for retention of one piece of large woody debris per acre that will further increase the potential for recycling of soil nutrients. Additionally there is a guideline to avoid nitrogen-based fertilization on the plateau, shoulder, and upper backslope landforms. These guidelines are not included in Alternative A.

There is not much change in suitable area for timber harvest on the plateau and shoulder landforms across alternatives (high of 116,000 to a low of 106,000, Table 3-3) but some of the changes between alternatives are from one management area to another so even though both are suitable, there is an expectation of reduced timber production (e.g. MA 3.0 changed to MA 2.2). Therefore, the risk of nutrient removal over the long-term in stem wood from vegetation management, though minimal as described above, is greatest under Alternative A. The risk of base cation leaching from application of nitrogen-based fertilizer, though the true effects are not completely understood at present by the scientific community, appears greatest in Alternatives A and B. The potential for use of nitrogen-based fertilizer for regeneration is greatest in Alternative A with decreasing potential for use in each subsequent alternative (Table 2-2).

There are design criteria in Alternatives B, Cm, and D that require salvage of topsoil prior to pit development and building construction. These design criteria are not in Alternative A. Under Alternatives B, Cm, and D there is the potential for approximately 3,200, 3,100 and 3,000 acres, respectively, to be “buried” and have soil nutrient processes limited by existing FS roads and potential new road construction (Table 3-3).

Soil erosion

Alternative A

Temporary erosion from even-aged management will be greater than the potential temporary erosion from uneven-aged harvest, but due to the different timing of stand entries the long-term erosion resulting from vegetation management will be about the same for all silvicultural systems (see LRMP Appendix A). In Alternative A there are approximately 75,000 acres suitable for timber harvest with an off-road/trail erosion hazard rating of severe or very severe (Table 3-4).

Table 3-3. Relative risk to soil nutrients from potential FS activities by alternative

Risk to Soil Nutrients	Alt. A	Alt. B	Alt. Cm	Alt. D
Plateau and shoulder landform suitable for timber harvest (1,000 acres)	118	114	116	106
Plateau and shoulder landforms where even-aged management is suitable and featured (1,000 acres)	111	96	87	41
Area buried under existing and potential new FS roads (1,000 acres)	3.4	3.2	3.1	3.0

Table 3-4. Proposed activities by alternative mapped on soil units with severe or very severe erosion potential ratings

Risk to Soil Erosion (activities on soils with a severe or very severe erosion potential rating)	Alternative			
	A	B	Cm	D
Area suitable for timber harvest on severe or very severe off-road/trail erosion potential soil (1,000 acres)	75	71	68	63
Potential new FS road on severe or very severe on-road/trail erosion potential soil (miles)	250	190	170	160
Existing FS road on severe or very severe on-road/trail erosion potential soil (miles)	600	600	600	580
IUA on severe or very severe on-road/trail erosion potential soil (1,000 acres)	46	56	41	21
Equestrian Use Area on severe or very severe on-road/trail erosion potential soil (1,000 acres)	0	6	6	30
Open equestrian riding area on severe or very severe on-road/trail erosion potential soil (1,000 acres)	258	249	231	0

There are approximately 250 miles of potential new FS road construction by 2060 and approximately 600 miles of existing FS roads on soil with an on-road/trail erosion hazard rating of severe or very severe. These road estimates go through 2060 to include the total potential new road system. Alternative A has the greatest potential for new FS road construction on soils with severe or very severe soil erosion ratings (Table 3-4). This indicates that the risk for soil erosion from roads is greatest in this alternative.

There are approximately 46,000 acres of IUA with an on-road/trail-erosion-rating of severe or very severe. There are no acres of EUA with an on-road/trail-erosion-rating of severe or very severe. The area not in an EUA that is suitable for open riding has the risk of user-created trails which have no design criteria or project specific mitigation measures to help limit erosion during development and from use of these trails. There are approximately 258,000 acres in open riding areas with an on-road/trail-erosion-rating of severe or very severe.

Alternatives B, Cm, and D

Of the soil map units that have an off-road/trail-erosion-hazard potential of severe or very severe, 71,000 acres are suitable for timber harvest in Alternative B; 68,000 acres in Alternative Cm; and 63,000 acres in Alternative D (Table 3-4). There are approximately 190 miles of potential for new FS road construction and approximately 600 miles of existing FS roads with an on-road/trail erosion-hazard-rating of severe or very severe in Alternative B; 170 and 600 miles in Alternative Cm; and 160 and 580 miles in Alternative D (estimates rounded to nearest 10 miles).

In Alternative B there are approximately 56,000 acres of IUA with an on-road/trail-erosion-rating of severe or very severe. In Alternative Cm there are approximately 41,000 acres and in Alternative D there are approximately 21,000 acres.

In Alternative B there are approximately 6,000 acres of EUA with on-road/trail erosion rating of severe or very severe. In Alternative Cm there are approximately 6,000 acres and in Alternative D there are approximately 30,000 acres. The trails in EUAs will be designed and constructed through project-level proposals and have design criteria and mitigations to limit associated erosion. There are approximately 249,000 acres in open riding areas with an on-road/trail-erosion-rating of severe or very severe in Alternative B; 231,000 acres in Alternative Cm; and no acres in Alternative D. Therefore, while Alternative D has the most area in an EUA on soil map units with a severe or very severe erosion rating, it is likely to have the least erosion from equestrian use because there is no open riding. In general, erosion rates from designed trails are much lower than from user-created trails.

Overall it appears that Alternative D has the lowest potential erosion related activities. Alternative D has the lowest suitable acres with severe erosion potential, the lowest potential new FS road construction on severe erosion soils, the lowest existing FS roads on severe erosion soils, the lowest area in IUAs on severe erosion soils, and no open equestrian riding.

Soil compaction, puddling, and rutting

Alternative A

By the mid-point of the second decade, there is the potential for an additional 307 miles of FS road construction that will provide long-term severe compaction on approximately 600 acres. Trail development in IUAs and EUAs will also produce long-term severe compaction. The potential will be moderate to high in this alternative with the second most acres in IUAs and no area in EUAs. User-created horse trails in open riding areas which is almost the entire ANF (approximately 493,000 acres) in Alternative A will also create long-term severe compaction if they receive continued use or short-term severe compaction if the use is ended or moved after only one season. The second is likely the case in more remote areas, but continued use will likely be the norm in areas surrounding concentrated private horse related developments, such as guide services.

Potential for compaction, rutting, and puddling is similar under both even- and uneven-aged silvicultural systems given that both require skid trails through a harvest unit assuming ground-based harvest. Therefore, the risk of compaction, rutting and puddling is determined by the area suitable for timber harvest: 467,543 acres in Alternative A. Of this area there are approximately 210,700 acres on soil map units with a severe soil rutting hazard due to low soil strength, and approximately 92,000 acres that are poorly suited for harvest equipment operability. The area in vegetation management units that is compacted is usually restricted to skid trails and log landings. These areas will usually be small enough and scattered so that infiltration and tree growth at the stand scale will not be detrimentally impacted. Soil compaction, puddling, and rutting are long-term effects on the soil that can last for decades.

Alternatives B, Cm, and D

There is the potential for approximately 590 acres of long-term severe compaction in additional road construction in Alternative B (new road construction on new and existing road corridors), approximately 520 acres in Alternative Cm, and approximately 470 acres in Alternative D (estimates rounded to nearest 10 acres). Potential for ATV trail development and the associated risk of long-term severe compaction will be greatest under Alternative B, less in Alternative Cm, and least in Alternative D. Horse trail development in EUAs will be the same in Alternatives B and Cm, but higher in Alternative D. Alternatives B and Cm have similar risk of compaction in open riding areas, while Alternative D has virtually no risk as there is no open riding allowed under this alternative.

The area suitable for timber harvesting on soil map units with a severe soil rutting hazard is approximately 202,000 acres under Alternative B, 197,600 acres in Alternatives Cm, and 190,000 acres in Alternative D. The area suitable for timber harvest on soil map units poorly suited for harvest operability is approximately 92,000 acres under Alternative B, somewhat less at 83,000 acres in Alternatives Cm, and least with 76,000 acres in D.

Under Alternatives B, Cm, and D there is design criteria to consider field soil conditions in allowing heavy equipment to operate. This guideline goes beyond what is in Alternative A, and bases operability on season and time of the year for soil protection and reducing susceptibility to compaction, rutting, and puddling.

Cumulative effects

Soil nutrients

The geology underlying the ANF is primarily composed of sandstones and shale with very little base cations, i.e., calcium and magnesium. As a result the soils formed from the bedrock are relatively lacking in these nutrients. Since most of the ANF was not glaciated, these soils are up to 770,000 years old. Due to the age of the soils, many base cations have leached out of the profile. Acid deposition in the region, although reducing in recent years, has likely contributed to leaching of base cations from the soil. A study of the changes in soil nutrients and pH over a 30-year period beginning in 1967, showed statistically significant reduction in exchangeable calcium and magnesium concentrations as well as pH throughout

the soil profile. Using modeling Bailey *et al.* (2005, p.688) showed that the level of reduction in calcium and magnesium over 30 years exceeded that which would have been expected to be utilized and stored in the trees on site. This indicates that some of these nutrients have been “lost” from the site. While other studies have not shown additional loss of nutrients from timber extraction (Johnson, Romanowicz, and Siccama 1997, p.867; Johnson and Todd 1998, p.1734), there is still a concern that cumulative effects could contribute to long-term loss of base cations. Monitoring the effects of soil acidification on physical, chemical, and biological soil properties has been identified as an LRMP research need (see table 16 in the monitoring section of the LRMP).

Future oil and gas development activities on ANF land and other land within the proclamation boundary of the ANF leads to long-term commitment of soil nutrients through road construction, pit development, and building construction. There is expected to be an additional 666 acres per year cleared for oil and gas development from now until 2020 (9,995 acres total, see Appendix F, Table F-5). By 2020 there is the potential for 3.7 percent of the area within the proclamation boundary to be in a long-term soil resource commitment state (e.g. under roads, well pads, buildings, etc.) where soil nutrients are lacking or buried.

Soil erosion

Currently there are approximately 1,269 miles of FS roads, an additional 240 to 307 miles of potential new FS roads by 2020 depending on the alternative, 708 miles of municipal road within the proclamation boundary, 2,940 miles of non-system roads within the proclamation boundary, and 1920 miles of potential new oil and gas roads by the mid-point of the second decade. These approximately 7,000 miles of road within the proclamation boundary will contribute to accelerated erosion from both the roadbed and excess runoff creating gullies. Non-system roads may become another road type, so the estimated totals have potential to be slightly elevated.

Vegetation management on private and other public lands (see cumulative effects in Forest Vegetation) in the proclamation boundary will also contribute to some level of accelerated erosion. Erosion from these sources will likely be similar to the erosion rates expected from FS vegetation management which is minimal provided State BMPs are followed.

An analysis of historic mass movement (e.g. landslides) on the ANF done in 1986 by the U. S. Geological Survey identified 489 historic mass movements totaling approximately 18,000 acres within the proclamation boundary (Pomeroy 1986, map plate 1). These events typically are triggered by large rain events where the whole soil profile becomes saturated (Eschner and Patric 1982, p.345-346; Schultz 1999, p.707-708). There have been few landslides or other forms of mass movement on the ANF since 1986 and a large majority are related to road construction. There is design criteria for FS roads to avoid areas prone to mass movement so the number and area of mass movement is expected to remain relatively low especially related to FS roads. Regardless, as stated above, large rain events can cause mass movement and there is no way to prevent the occurrence of such an event only limiting the susceptibility of areas to mass movement as with road design criteria. The level of oil and gas development expected may cause developers to go into more landslide-prone areas with road and well pad construction which will make an area additionally susceptible to mass movement.

Although minor relative to erosion across the ANF, erosion of the shoreline of the Allegheny Reservoir is affected by fluctuation of the water level in the reservoir controlled by the U.S. Army Corp of Engineers. This fluctuation is typically seasonal (i.e., higher in spring and summer; lower in fall and winter) but can be affected by single rainfall events. As the water level rises the shoreline gets saturated and is less stable, but is usually supported by the water. However, as the water level falls, support is removed and the shoreline is more susceptible to slumping and erosion. The area between high and low water levels is also typically more susceptible to erosion in general as there is no vegetation to reduce erosion. Shoreline erosion along the Allegheny Reservoir is expected to continue into future decades.

Soil compaction, puddling and rutting

Since 1986, ANF vegetation management has occurred on approximately 86,900 acres. An additional 23,600 to 71,000 acres are expected by the mid-point of the second decade on NFS land. Some of this area may have received more than one vegetation treatment making the area under vegetation management look higher than it really was or is estimated to be in the future. Additional vegetation management has occurred on private or other public land within the proclamation boundary since 1986 and more is expected on private and other public land (see cumulative effects section in Forest Vegetation for estimates). Almost all of this area has some potential for compaction, puddling, and rutting due to the use of heavy equipment. Some of this area has had vegetation management activities more than once during the cumulative effects timeframe. In stands receiving even-aged management thinning, shelterwood harvest, and removal harvest more than one entry could occur. In stands receiving uneven-aged management harvest, entries occur approximately every 20 years. Soil compaction, puddling, and rutting are long-term effects on the soil that can last for years to decades.

Road mileage cumulative effects shown under soil erosion represent the area that will have long-term severe compaction within the proclamation boundary. Additional housing development, though slight will also be expected on private property within the proclamation boundary. Other activities causing compaction within the Forest include ATV/OHM and horse use. Cumulatively (by 2020) approximately 3.7 percent of the land area within the proclamation boundary could be compacted in the long-term (e.g. under roads, well pads, buildings).

3.2.3 Water Resources

The design criteria for the Water Resources section in 2500 Watershed and Air of the LRMP were reorganized and clarifications were made. Major changes include: The Allegheny River riparian corridor was increased from 100 feet to 300 feet and direction was changed; Heavy equipment direction was added for Riparian Corridors and Wetland Management Zones; Heavy equipment is now allowed up to 10 feet from intermittent streams, but restrictions will still be in place to protect soils and subsurface hydrology; Direction was added for the management of surface runoff; Substantial changes were made to the Wetlands section; Wetlands now have a zone of limited activity of 100 feet and vernal pools have a zone of limited activity of 200 feet; Definitions and Table-27 in the LRMP were added for Wetland Management Zones; Wilderness Trout Stream Guidelines were changed to standards.

In the Affected Environment, more information was included under Surface Water for seeps and vernal pools. In 2006 the Existing Use Classifications for 3 streams was updated by the DEP. Segments of East Hickory and Middle Hickory Creek and Messenger Run were upgraded from a High-Quality Cold Water Fisheries to an Exceptional Value water. The 2004 303(d) listed streams were updated for the 2006 303(d) list, which included the addition of the West Branch of Millstone Creek.

In the Environmental Consequences, changes were made to discussions on vegetation management, reforestation treatments, road construction, and riparian corridors to reflect the changes in the LRMP and Table 2.2.

In the Cumulative Effects section, the discussion was edited for oil and gas development.

Affected environment

Watersheds

Watershed description

The ANF comprises a portion of three hydrologic units at the 4th Level Hydrologic Unit Code (HUC) scale known as sub-basins. They are located in the Allegheny River Basin which drains to the Ohio River and then to the Mississippi River. Within the sub-basins are 15 watersheds at the 5th level HUC which are presented in Table 3-5 (See also Figure 3-1). These watersheds are delineated by the Natural Resources Conservation Service (NRCS) with some refinement of the watersheds by ANF staff (e.g. breaking the Reservoir and North Allegheny Front at the Kinzua Dam). They range from 77 square miles to 258 square miles in size. Twelve watersheds have more than 20 percent ANF ownership and 6 of these have more than 50 percent ANF ownership. The ANF could have a considerable influence on the condition of these watersheds through Federal management actions and collaboration with others. The remaining 3 watersheds have less than 20 percent ANF ownership. In these watersheds, the ANF could affect conditions through collaboration with other agencies or watershed groups that take the lead role in assessment and management.

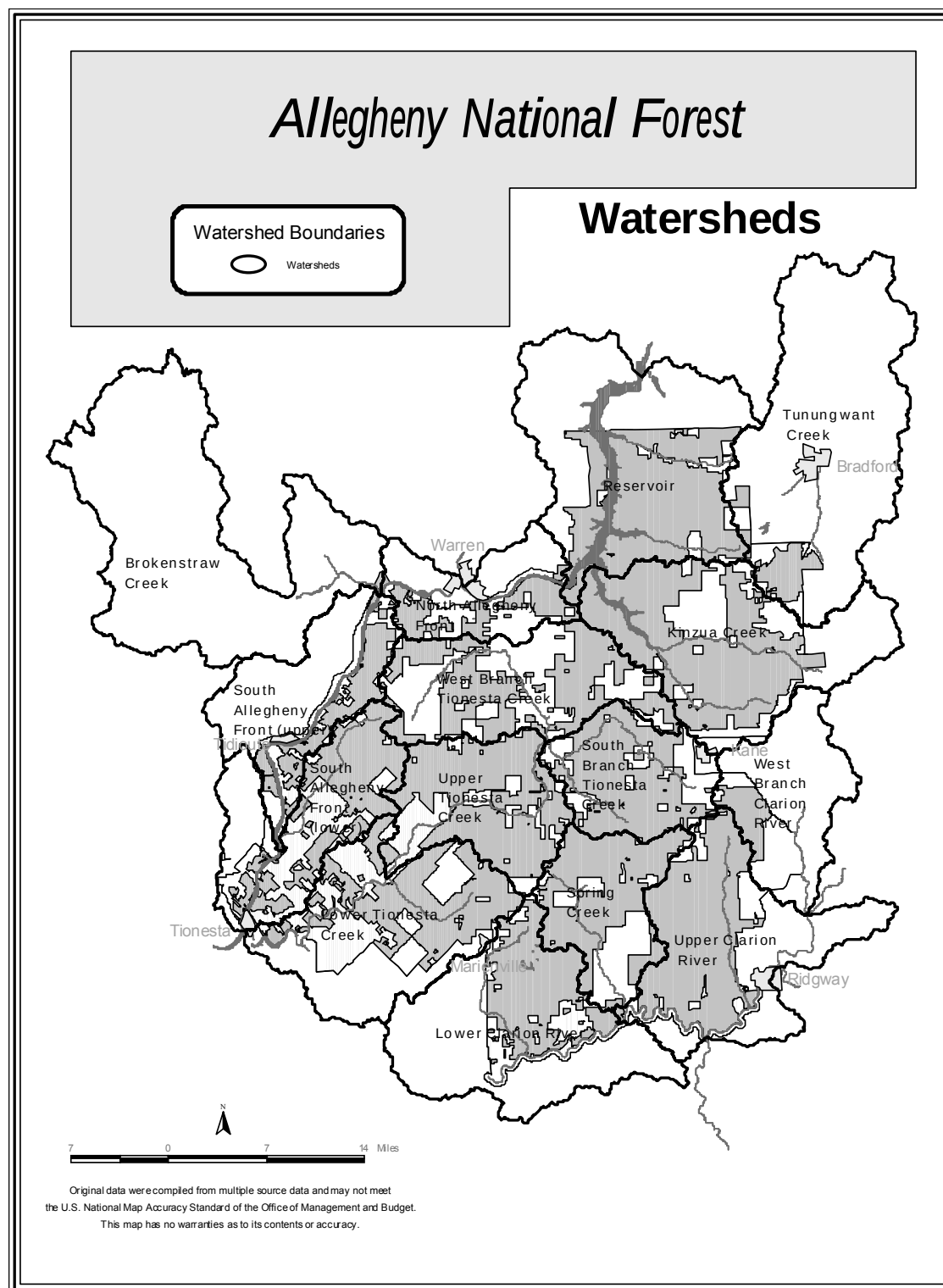
The stream pattern is dendritic across most of the forest. Floodplains on the ANF are narrow in relation to their associated stream sizes due to the absence of glaciation on the ANF. Riparian areas are bound by steep topography which limits floodplain development and allows only moderate sinuosity or meandering. Therefore, streams are generally “flashy” after storm events, compared to streams in areas with wider forested floodplains or extensive wetland systems that are able to absorb more of the water into the floodplain and release it slowly over time.

Watersheds on the ANF have much slower response times for streamflow than urban landscapes because the forested cover ranges from 87 percent to 99 percent and the amount of impervious area is about 2 percent. The forested conditions on the ANF also correspond to the number of streams with high and exceptional water quality. Flooding of areas along the Allegheny River downstream of the Kinzua Dam is controlled by flow releases from the dam. The dam has altered the natural flow patterns and sediment regime of the river, which has probably caused changes in the natural processes of the river.

Table 3-5. Sub-basin, watersheds and acres, and percent FS lands within each

Sub-Basin Name (HUC 4)	Watershed Name (HUC 5)	Watershed HUC 5 Code	Square Miles	Percent NF ownership
Upper Allegheny River	Tunungwant Creek	5010001140	238	5.9
	Kinzua Creek	5010001215	178	58.3
	Reservoir	5010001220	219	41.7
	North Allegheny Front	5010001225	77	30.4
	Brokenstraw Cr.	5010001280	258	0.2
Middle Allegheny River and Tionesta Creek	South Allegheny Front (Upper)	5010003010	109	24.0
	South Allegheny Front (Lower)	5010003015	116	45.0
	South Branch Tionesta Cr.	5010003020	86	71.4
	West Branch Tionesta Cr.	5010003030	131	51.9
	Tionesta Cr. (Upper)	5010003040	104	75.5
	Tionesta Cr. (Lower)	5010003045	158	40.1
Clarion River	West Branch Clarion River	5010005020	93	11.6
	Spring Cr.	5010005050	88	70.7
	Clarion R. (Upper)	5010005060	160	52.2
	Clarion R. (Lower)	5010005065	174	30.1

Figure 3-1. Watersheds on the Allegheny National Forest



The climate of the area is temperate with a mean monthly maximum of 79 degrees Fahrenheit and a mean monthly minimum of 15 degrees Fahrenheit. Precipitation usually occurs evenly throughout the year and averages 46 inches annually. About half of the total has the potential of falling as snow or rain during the colder months of October through April. During this time period, rain-on-snow driven runoff events are common and can create some of the largest streamflow peaks during the year. During the summer months, when some of the greatest monthly precipitation occurs, intense thundershowers can also generate large peak flows. The average runoff for streams near the ANF ranges from 25 to 27 inches per year (Siwicki 2005), leaving 19 to 21 inches of precipitation to be accounted for, in the annual water budget, by storage and evapotranspiration.

ANF assessments and findings to date

In 2001, the ANF conducted a Watershed Integrity Ranking to assess the overall condition and vulnerability of the 15 watersheds in which the ANF is located (USDA FS 2001f). For this assessment, the East-wide Watershed Assessment Protocol was followed and geographic information systems (GIS) data were utilized to assess a given watershed's relative condition and vulnerability (USDA FS 2001f). Watersheds have also been assessed during some project level analysis, which have recently covered several 6th level sub-watersheds. One Ecosystem Analysis at the Watersheds Scale was completed on the Spring Creek 5th level watershed (USDA FS 2003e). Another was a forest level roads assessment that resulted in the Forest Wide Roads Analysis Report (USDA FS 2003b). This document identified roads of high concern to water resources. These different assessments drew the following conclusions about watershed health on the ANF:

- The most vulnerable watersheds (Brokenstraw, N. Allegheny Front, Clarion River (upper), Kinzua Creek and Tunungwant Creek) are on the edges of the ANF boundary (USDA FS 2001f) and usually have higher populations and more developed land use. However, this also means that the ANF's role in improving the condition of these watersheds is limited. This highlights the importance of working with local cooperators (i.e., watershed associations) to improve watershed conditions where necessary.
- The primary activities that could potentially have a negative effect on watershed resources are road construction, activities associated with oil and gas extraction, vegetation management, and heavy recreational use.
- Hydrologic modification occurs in all the watersheds, largely due to roads.
- The major cause of sedimentation comes from roads less than 300 feet from streams or at stream crossings. Placing limestone on roads within 300 feet from streams can reduce sediment loads coming from pit-run surfaced roads. The road analysis matrix estimates that about 1,636 miles of road on the ANF have a high risk of influencing local stream channels and water quality due to pit-run type surfacing and proximity to a stream channel.
- Watersheds are well forested, with 14 of the 15 watersheds having 87 percent to 99 percent forestland. Brokenstraw watershed has the lowest forested cover, but has 0.2 percent in FS ownership. This watershed is 67 percent forested, 30 percent agricultural, and 2 percent urban. The North Allegheny Front and the Tunungwant watersheds have the highest percentage of land in urban land use, both around 6 percent. Even watersheds with a low percentage of FS ownership have low development rates.

- Most streams have fair habitat complexity but lack instream large wood.
- Riparian areas are lacking seedling development due to browsing by deer and interference from dense fern and grass cover. This problem can delay reforestation following natural catastrophic events. (USDA FS 2003e, p. 52)

Surface water

Streams

There are 2,126 miles of mapped streams within the ANF proclamation boundary, and there are 1,468 miles on FS lands. Due to mapping omissions and seasonal changes the amount of unmapped perennial and intermittent streams is estimated to be 1,500 miles as digitized from historic maps within the proclamation boundary. Of these unmapped streams, only 130 miles are shown as perennial and the rest are intermittent.

Water bodies

Current ANF data show 273 water bodies either entirely or partially on the ANF. Most of these are man-made ponds and reservoirs created for flood control, water supply, recreational, and wildlife purposes. The largest reservoir on the NF lands is the Allegheny Reservoir, which encompasses 7,647 acres. There are many other small and large impoundments scattered across the Forest that amount to 488 acres, which range from 0.02 acres to 77 acres. Tionesta Lake, 383 acres formed by a dam on Tionesta Creek, borders the ANF. Another type of water body on the ANF results from dams created by beavers. These dams are limited to areas with wide floodplains and low gradient and are usually very small. Small ponds are also created by oil and gas operators for containing hydrofracturing fluids.

Extensive wetland areas do not exist across the majority of the forest. In most cases, wetlands are located in floodplains along streams, at the head of drainages, on side slopes, and in flat and concave landforms such as benches and depressions. Within the ANF, there are 1,261 mapped wetlands found from the U.S. Fish and Wildlife Service National Wetland Inventory (NWI). Where NWI wetlands are found, there is high probability of the occurrence of additional wetland acreage. Additional forested and non-forested wetlands exist across the ANF that are identified and analyzed at the project level and protected during implementation.

Springs, seeps, and vernal pools are also considered wetlands because of the presence of hydric soils, water, and hydrophilic vegetation. The majority of springs and seeps on the ANF do not appear on topographic maps, and these unique ecosystems can be quite extensive. Seeps primarily occur on strongly sloping to steep side slopes and low slope colluvial landforms. Seeps are very important foraging and breeding habitat for some salamander and invertebrate species and the moist corridors surrounding seeps are important for salamander migration and dispersal. The area surrounding the springs and seeps is also important to plant distributions. During the winter months as the groundwater melts or reduces snow cover, seeps are important foraging areas for wild turkey, deer, and other wildlife. Canopy cover needs to be maintained around seeps and springs to maintain micro-climate and prevent conversion to grass or fern cover. Vernal pools are naturally occurring small pools or depressions that are inundated for a period of time each year, primarily late fall through spring, as a result of a combination of snowmelt, precipitation

and high water tables. These pools dry up for a period of time, generally during the summer and early fall. Vernal pools are free of fish and the pool basin is used as breeding habitat for pool-dependent amphibians and invertebrates. In addition to the breeding pools, the surrounding upland forest is critical habitat that is used by pool-breeding amphibians during their life cycle.

Protected water uses and criteria necessary to protect each use

Protected water uses are designated by the Pennsylvania Department of Environmental Protection (PA DEP) for all state waters, and are inclusive of the following: aquatic life; water supply for potable, industrial, livestock, wildlife, and irrigation uses; and the recreational uses of boating, fishing, water contact sports, and aesthetics (PA DEP 2001). Of the mapped streams in the proclamation boundary, 67 miles are designated exceptional value (EV), 1,525 miles are designated high quality cold water fishes (HQ-CWF), 418 miles are designated cold water fishes (CWF), and 41 miles are designated warm water fishes (WWF). Therefore the majority of streams on the forest should be managed in a way that maintains and/or propagates fish species as well as flora and fauna, which are indigenous to a cold-water habitat. Several streams have been upgraded over the years because macroinvertebrate sampling indicated high water quality. In 2001, segments of Brown's Run sub-watershed were upgraded from a CWF to an EV. In 2006, segments of East Hickory and Middle Hickory Creek and Messenger Run were upgraded from a CWF to an EV (PA DEP 2006a). Minister Creek is also being reviewed for upgrade from a HQ-CWF to EV.

The upgrades over the years on streams on the ANF indicate that water quality is among the highest in the state. The PA Division of Water Quality Assessment and Standards has assessed trends on regularly sampled streams (PA DEP 2004). Of the streams where trends were significant, Tionesta Creek and Clarion River best represent conditions resulting from management activities on the ANF. Both of these streams expressed a decreasing trend in nitrate. This report also stated that there are positive trends in water quality for all regions in PA except the southeast.

However, water chemistry in the area has low buffering capacity due to acidic bedrock and soils in combination with acidic deposition. This can be exacerbated by acidic deposition as discussed in the air section (sulfur dioxide and acid deposition). Acidic deposition has been shown to degrade water quality by lowering pH levels (i.e., increasing acidity), decreasing acid-neutralizing capacity (ANC), and increasing aluminum concentrations (Driscoll *et al.* 2003). During snow melt or large rain events, episodic acidification can exacerbate pH, acid neutralizing capacity, and alkalinity and release high levels of aluminum by causing a pulse of acids and/or dilution of base cations (e.g. calcium and magnesium). Research on streams in central and southwestern Pennsylvania have shown severe and chronic episodic acidification causing fish mortality and affecting fish distribution (Baker *et al.* 1996).

Water temperature monitoring on the ANF has shown that 1st through 3rd order streams are generally meeting daily average water temperatures suitable for cold water species (68° F), but larger streams generally exceed this standard from July through August because of the wide surface area exposed to solar radiation. Sedimentation above natural levels is also a concern in streams throughout the forest, and has been documented at several locations (PA DEP 2002). Sediment sources on the ANF can originate from road runoff, activities associated with oil and gas extraction, vegetation management, and heavy recreational use. Elevated levels of sediment can cause scouring during high flows, fill interstitial spaces

necessary for macroinvertebrates, reduce available habitat (e.g. pool depth), and reduce the algae- and bacteria-based food supply.

The DEP has antidegradation requirements as a component of its water quality standards (PA DEP 2003). The objective of the antidegradation policy is that, at a minimum, existing instream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected. Some limited point and nonpoint source discharges may be allowed, providing that they are of limited activity that results in no more than temporary and short-term changes in water quality. This means that degradation is limited to the shortest possible time, and is only allowed after all practical means of minimizing it are implemented.

There are a few water bodies on the ANF that are listed as impaired on the 2006 303(d) list of water quality limited streams and lakes (PA DEP 2006), but most of them are related to natural chemistry or atmospheric deposition (Table 3-6). Mercury is a common pollutant in many streams and lakes throughout Pennsylvania and the source is not always known (PA DEP 2004), although it is suspected to be from atmospheric deposition. Fish consumption advisories are published on the PA DEP website. West Branch of Millstone Creek was added to the 2006 303(d) list for metals, pH, and siltation from natural sources. More investigation is needed on this stream to determine if there are other sources of impairment. The source of pollution for Dutchman Run, within the Browns Run watershed, is originating from residential developments along the stream (PA DEP 2001a). The 2001 report states that roadways, oil and gas extraction, and timbering do not appear to be impacting overall water quality. In addition, the reach of stream that was assessed above the town of Clarendon, but downstream of FS land was upgraded to an Exceptional Value water based on the presence of high quality aquatic communities.

Table 3-6. Streams on the 303(d) list of water quality limited streams and lakes

Stream or Lake	Non-Support	Source	Pollutant
Allegheny River	Human Health	Unknown	Mercury
Brokenstraw Creek	Human Health	Unknown	Mercury
Clarion River	Human Health	Unknown	Mercury
Tionesta Creek	Human Health	Unknown	Mercury
Allegheny Reservoir	Human Health	Atmospheric Deposition	Mercury
East Branch of Millstone Creek (5010005065)	Aquatics	Natural Sources	pH
West Branch of Millstone Creek (5010005065)	Aquatics Life	Natural Sources	Metals pH Siltation
Dutchman Run (5010001225)	Aquatic Life	Package Plants Removal of Vegetation On Site Wastewater	Low dissolved oxygen Siltation Nutrients

Consumptive water uses

Water supply systems

A municipal supply watershed is the area which contributes water to a public water supply system, as defined in FSM 2542.05. Not included are communities served by a well or confined ground water not affected by most surface activities. The three municipal watersheds on the ANF are Bradford, Johnsonburg, and Ridgway, which are located in the West Branch Tunungwant Creek, Silver Creek, and Big Mill Creek watersheds, respectively. The ANF manages 4,064 acres (15%) within West Branch Tunungwant Creek watershed, 348 acres (16%) within Silver Creek Watershed, and 18,731 acres (93%) within Big Mill Creek watershed. The municipalities test and report water quality to the state.

There are 38 known water systems that exist on ANF property that are used for public water, residences, or non-potable uses. Of these systems, 31 are transient non-community systems that serve campgrounds or picnic areas. One of the systems also serves the Bradford Administrative Office. These systems are tested and results are supplied to the state. Throughout the ANF, several other roadside springs exist that are not maintained for public consumption.

Riparian corridor

Riparian areas are transition zones between terrestrial ecosystems and aquatic ecosystems (e.g. streams, lakes, and wetlands). Riparian areas extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width (Ilhardt *et al.* 2000).

Healthy and properly functioning riparian areas are physically and biologically diverse and highly productive environments. These land-water interfaces are generally very dynamic and support complex associations of upland and animal communities. Riparian areas also maintain or improve water quality, moderate impacts of flooding, and provide continuous groundwater recharge areas. The areas are also attractive for their diverse scenery and recreation potential. Riparian areas act as a buffer to trap sediment and nutrients moving from upland areas, moderate stream temperatures, provide streamside cover and food for wildlife, provide large wood reserves and organic matter to riparian areas and aquatic systems, maintain overall channel stability, and moderate cumulative effects of actions within the watershed.

Digitally-mapped floodplains, wetlands, and riparian buffers are discussed as riparian corridors. The number of acres within the mapped riparian corridor was calculated using the miles of perennial and intermittent streams on the ANF that are digitally mapped from U.S. Geological Survey (USGS) 1:24,000 topographic maps. To account for streams not shown on USGS maps, streams were digitized from historic maps to provide a better account of the true mileage of 1st and 2nd order streams. The previously unmapped stream miles total 1,500 miles that are widely distributed geographically, and provide significant importance to the stream systems as a whole. Also, the mapped National Wetland Inventory (NWI) wetlands, other water bodies, and floodplain ecotypes are included in the riparian corridor. Finally, the buffers in Table 3-7 were applied to these water bodies to determine the acreage.

Table 3-7. Fixed-width distances for the delineation of the riparian corridor in Alternatives B, Cm, and D

Water Features	Distance from each bank or high water mark, measured as slope distance
Allegheny River	Minimum of 300 feet
Wilderness Trout Streams, Remote Trout Streams, or Class A Trout Streams	Minimum of 200 feet or 50 feet plus 4 feet for every 1 percent of slope, whichever is greater
Perennial streams and other perennial water bodies	Minimum of 100 feet or 50 feet plus 4 feet for every 1 percent of slope, whichever is greater
Intermittent streams and mapped wetlands. Water does not need to be present on the surface at the time of inventory.	Minimum of 50 feet plus 2 feet for every 1 percent of slope

Using the mapped water features and proposed buffers, the total riparian corridor area will be 57,039 acres in Alternatives B, Cm, and D. Alternative A will have less acres in the riparian corridor because it will not include an increase in buffer width for Wilderness Trout Streams, Remote Trout Streams, and Class A Trout Streams and the minimum width for perennial streams. Table 3-8 shows the approximate distribution of forest age within the riparian corridor. Almost 80 percent of the riparian corridor is in forested condition, with the majority of the openings being water bodies. Open areas include areas covered with lowland shrubs, upland shrubs, sparsely stocked trees or ferns and grasses. They do not include permanent openings, including pipelines, roads, and openings for wells.

Within the riparian corridor, several forest health concerns exist that are addressed in more detail in the Vegetation Management section. Table 3-8 shows that the age distribution within the riparian corridor is similar to the rest of the forest and will have related forest health concerns, with more than half of the forest over 80 years old. In actuality, there is a higher proportion in the mature age group because vegetation management within the riparian corridor has been avoided. MA 3.0 surveys in 1992 determined that close to 70 percent of all riparian areas are stocked with enough ferns, grass, striped maple, and beech brush to interfere with desired tree seedlings and herbaceous vegetation (USDA FS 1995a, p. 26). Only 10 percent of riparian areas are adequately stocked with tree seedlings on the ground (well below the 23% average for all of MA 3.0) to provide vertical structure and sustain forest cover if the overstory were to experience significant mortality or decline (USDA FS 1995a p.26).

Table 3-8. Distribution of forest age across ANF lands within the riparian corridor

Riparian Corridor Forest Cover Age	Percent of Riparian Corridor
Water	15.0
Open Areas	5.7
0-10 Years Old	3
11-80 Years Old	24
81-150 Years Old	52
Greater than 151 Years Old	0.5

Most of the riparian areas across the ANF were logged and many were disturbed by roads and railroads by the beginning of the 20th century. Today, riparian areas are generally in a mid- to late-structural stage of forest development and riparian vegetation provides excellent canopy over streams. Most of the current disturbances in these areas are the result of access roads, activities related to OGM development, trails, developed recreational areas, and dispersed recreation. Natural disturbances result from floods, wind, insect infestations, and disease.

A comparison of three streams on the ANF shows that in-stream large wood increased with riparian forest age (Williams and Moriarity 1999). Riparian areas are beginning to contribute large wood (e.g. small trees, limbs, and trees affected by mortality and windthrow) to stream channels and to recover the ecological processes and functions such as storage of sediment and coarse organic matter in small tributary streams and the creation of larger, deeper pools (Dolloff and Webster 2000). The current habitat is largely defined by a high frequency of riffle and glide features with few pools. Since pool habitat is important for aquatic organism survival and propagation, streams on the ANF may not fully meet Pennsylvania designated protected water uses due to the lack of adequate aquatic habitat in the form of pools. It will take several more decades of careful riparian area stewardship before these ecological processes are fully affecting larger fish-bearing streams.

Direct and indirect effects

Scope of analysis

The analysis area for direct and indirect effects will be analyzed on FS lands within the proclamation boundary. Within this area, water resources are potentially subject to impacts as a result of land management activities implemented under the LRMP. Activities that have beneficial or negative effects on water resources including streams, wetlands, reservoirs, springs, and seeps will be analyzed.

The hydrologic unit chosen for cumulative effects analysis is 5th level watersheds. This is an appropriate size area to determine effects from the LRMP because beyond this point effects are expected to be diluted. Streams on the ANF drain both from private and other public lands and to other public and private lands; therefore activities on the ANF can affect downstream users and be affected by upstream users. Data analyzed for cumulative effects will be from within the ANF proclamation boundary because the dataset outside of this boundary will not be comparable to the data available within the boundary. Also, water quality is believed to be comparable inside and outside the proclamation boundary because the four county area has similar forest cover and development rates as within the proclamation boundary. The time frame for this analysis will be from 1990 to 2020. This length of time is needed to project trends from past levels of disturbance to those projected in the new period.

Introduction to effects

Forest Service activities that impact water quality and quantity will be discussed. Water quality deals with the physical, chemical, and biological characteristics of water. Knowledge of water quality characteristics helps to evaluate the ability of the water to support protected uses. Water quality effects will be addressed where they impact streams and wetlands. Water quantity deals with streamflow response after storms, spring runoff, and low flow periods. Watershed conditions can have indirect effects on water quantity.

Water quality

Vegetation management

Timber management can affect a number of watershed processes and aquatic ecosystem functions by the removal of timber and potential for ground disturbance. Potential effects depend upon the quantity of timber removed, logging methods employed, and site-specific conditions. Removal of timber can potentially affect hydrologic cycles, nutrient cycles, large wood recruitment, stream shading, organic inputs, and channel and bank stability. These effects will be minimized through forestwide direction (i.e., standards and guidelines) for soils, riparian corridors, and wetland management zones. This direction meets or exceeds Pennsylvania's forestry best management practices (BMPs) which are effective at controlling nonpoint source pollution (Lynch and Corbett 1990; Stuart and Edwards 2006). Water quality protection is achieved in riparian and wetland areas when the majority of land-disturbing activities are kept 10 m to 30 m from streams and wetlands with greater widths being required on steeper slopes (Richards and Hollingsworth 2000). This is very similar to the approach used on the ANF for riparian corridors. Also, timber harvesting practices on the ANF strive to minimize soil disturbance and maintain the forest floor which is critical for minimizing erosion and sedimentation (Stuart and Edwards 2006).

Roads, trails, and landings are the primary cause of erosion and sedimentation from timber harvesting where BMPs have not been properly applied (Stuart and Edwards 2006). Research has shown that where BMPs are properly employed and forest floor disturbance is minimized, significantly less erosion and sedimentation occur (Phillips *et al.* 2000, Stuart and Edwards 2006). Standards and guidelines for soil and water resources, including riparian corridors and wetland management zones, are designed to keep sediment out of streams and wetlands. These standards and guidelines meet or exceed PA forestry BMPs. Pennsylvania's BMPs (and similar BMPs in other states) will keep sediment levels on well managed forest lands within the normal range that occurs on undisturbed forestland (Lynch and Corbett 1990; Stuart and Edwards 2006). A Pennsylvania study utilizing state forestry BMPs found that levels of sediment are not large enough to cause concerns to municipal supply reservoirs (Lynch and Corbett 1990). In this study, 110 acres of the 257 acre watershed were clearcut, which is much more intense than the typical harvest that would occur within a watershed on the ANF.

When streamside vegetation that provides shade to the stream channel is removed, solar radiation is allowed to enter the water and cause warming. The majority of all vegetation management treatments will be kept outside the riparian corridor, thereby protecting stream temperatures (see Table 3-7 and standards and guidelines.) Mitigation measures (i.e., 50 feet from intermittent streams and 100 feet from perennial stream channels plus additional distance for slope) were found to be adequate to protect aquatic life and other Commonwealth protected water uses by protecting the channel from solar radiation (Lynch and Corbett 1990). Only treatments that improve composition and diversity of vegetation will be allowed within the riparian corridor, and these treatments will be designed to minimize downstream increases in stream temperature.

Hemlock is located along many stream drainages. If hemlock woolly adelgid kills a large portion of hemlock in the riparian corridor, or areas adjacent to streams are blown down, increases in stream temperature could occur. Effects will depend on the remaining cover of the stream channel and regeneration of other tree species. Introduction of other conifer species and maintenance for the health of all conifer species is important in the riparian corridor.

When logging, including clear-cutting, and related activities, are conducted following BMPs, changes in stream water chemistry are small or of short duration and should not adversely impact water quality (Stuart and Martin 2006). At the Leading Ridge Watershed study in central Pennsylvania, Lynch and Corbett (1990) found that concentrations of potassium, nitrate, and some macronutrients in streams periodically increased for up to 9 years following harvesting. These losses were small and within drinking water standards (Lynch and Corbett 1990, Stuart and Edwards 2006). Pennsylvania Bureau of Forestry (BOF) BMPs were applied during this study and were found to be effective at reducing nutrient losses (Lynch and Corbett 1990). On the ANF, nutrient losses could be reduced further because a 50-foot buffer on intermittent streams is incorporated, whereas the PA BOF began applying this buffer after this study. In the Soil Section, LRMP standards and guidelines for vegetation management are discussed that will help abate nutrient concerns in streams (Hornbeck and Swank 1992, Martin *et al.* 2000).

Timber harvesting can increase nitrogen loss which can also affect the acidity of the streams (Baldigo *et al.* 2005). A study in Catskill Mountain streams in New York analyzed stream acidification and mortality of brook trout as affected by different harvesting methods (Baldigo *et al.* 2005). Water quality and trout mortality were affected by episodic acidification only in the clearcut stream which harvested 73 percent of the basal area, and were not affected in the watershed which harvested 14 percent of the basal area (Baldigo *et al.* 2005); however, this study did not determine a threshold for effects from timber harvesting on water quality and trout mortality, and is specific to the Catskill Mountains. Due to the near clearcut of this watershed, peak flows were increased in addition to base flows. Acidification occurred during the peak flows.

Levels of proposed timber harvesting on the ANF should not increase occurrences of stream acidification (i.e., pH and acid neutralizing capacity) or cause trout mortality. Projects are planned in watersheds on the ANF to minimize increases in streamflow through maintaining stream and wetland buffers, staggering harvest times and encouraging rapid regeneration (Martin *et al.* 2000). As mentioned above, standards and guidelines will be applied to minimize nutrient loss that may contribute to stream acidification.

Reforestation treatments

The use of herbicide and fertilizer to aid in reforestation is a common practice on the ANF, as well as other lands on the Allegheny Plateau. The behavior of glyphosate and sulfometuron methyl in soil, water and groundwater is covered in more detail in Appendix G1 (pages G1- 40 to 47, G1-103 to 109). For glyphosate, soil degradation is fairly rapid and it adheres strongly to soil particles and does not have a tendency to leach (page G1-42). In aquatic systems, glyphosate is

strongly adsorbed to both organic and mineral matter and is mainly degraded by micro organisms (page G1-44) and was shown to dissipate rapidly in standing water with half-lives of 1.5 to 3.5 days (page G2-46). We expect glyphosate to behave similarly in saturated and non-saturated soils, i.e., strong adsorption to soil organic and mineral matter with a rate of dissipation similar to that found in standing water. There is little or no likelihood of ground water contamination because of the tendency of glyphosate to bind to soil organic matter and its subsequent rapid microbial degradation (page G1-44).

Based on the findings in the herbicide risk assessment, sulfometuron methyl will be neither very persistent nor mobile in the types of soils found on the ANF because of the generally higher level of organic matter and the lower pH (pages G1-104 to 106 for details). The layer of vegetation and litter present on the ground promotes infiltration into the soil. This decreases the likelihood of surface runoff of water which might contain chemical residues and increases the likelihood of the movement of this water into the upper portions of the soil. The high levels of organic matter in the ANF soils will limit the movement (leaching) of sulfometuron methyl and accelerate its rate of decomposition. The findings in the herbicide risk assessment indicate sulfometuron methyl would behave similarly in saturated and non-saturated soils, i.e., strong adsorption to soil organic and mineral matter. The herbicide risk assessment notes that its dissipation rate in water is uncertain, but based on the information cited in detail on pages G-1 (Pages 104 to 106) it was concluded that there is no expectation it will be persistent in soils or leach to groundwater. The sulfometuron methyl formulation proposed for use is labeled for use on intermittently flooded low lying sites, seasonal dry floodplains and transitional areas between upland and lowland sites when no water is present and in marshes, swamps, and bogs after the water has receded.

All the glyphosate formulations proposed for use on the ANF are labeled for aquatic use. The surfactant constituents are all on either US EPA list 3 or 4B. List 3 indicates that there is unknown toxicity; for inerts where “there was no basis for placing it on any of the other lists. List 4B indicates materials which are considered to be of minimal concern and for which there is sufficient information to conclude that the current use patterns in pesticide products will not adversely affect public health and the environment. See G-1, Pages 2, 13, 14, 36, 37, and 101 for more details on surfactants and inerts and the EPA list definitions. The Agency (US EPA) will continue to evaluate these chemical substances, as additional information becomes available, to determine if reclassification to List 1, 2, or 4 is appropriate.” The herbicide risk assessment notes however that all the surfactants proposed for use on the ANF are also labeled for aquatic use.

Based on the analysis conducted for the herbicide risk assessment, new water resource buffers were developed for glyphosate and sulfometuron methyl which will provide for necessary protection of human health or aquatic species (in Section 2100-Environmental Management: Pesticide Use in the ANF LRMP, p. 57, 58). Although buffers have narrowed since the 1986 Forest Plan, the new buffer strategy was developed incorporating the experience of ANF managers with the management of power line right-of-ways, and the results of ANF monitoring of silvicultural and power line management operations (USDA FS 1988 p.18-19, 1989 p.15-17, 1990 p.22-24, 2002 p.50-51) and buffer-width research (Appendix G, p. G2-56 to 59 and G2-67

to 70). Chemical water quality monitoring has shown no detectable concentration of glyphosate or sulfometuron methyl in water samples tested (Appendix G, p. G2-11).

To minimize impacts to wetlands or riparian areas, herbicide standards and guidelines found in the LRMP will be implemented on all areas where herbicide is applied. These include marking treatment area boundaries and excluding treatment and/or equipment from buffer areas. Directional spraying away from buffer strips minimizes the chance of any herbicide falling within streams, wetlands, and other wet areas. Buffered areas would be adjusted at the time of application to reflect conditions at that time. Other mitigation measures include buffering ditches where runoff into a stream could occur, spraying away from protected areas, restricting application during wind and rain to avoid drift or runoff, and following all herbicide label directions, which are listed in Section 2100-Environmental Management: Pesticide use in the ANF LRMP. Also, herbicides will be applied in areas of dense understory vegetation which will intercept the herbicides before it reaches the ground. In combination with these mitigations, the low application rates used on the ANF reduce potential of streams exceeding water quality criterion for these chemicals.

Four years of water testing on the ANF found no detectable levels of herbicide downstream from areas treated to achieve reforestation objectives (USDA FS 1988 p.18-19, 1989 p.15-17, 1990 p.22-24, 2002 p.50-51). In 1998 and 1999, monitoring of herbicide treatments on powerline rights-of-way found the same results. In 1999, for example, water samples collected downstream from a right-of-way treatment contained no detectable herbicide with buffer strips as narrow as 13 feet for cut-stem treatment (with glyphosate) or 58 feet for low volume foliar treatment (USDA FS, 2001d, p.43, 44). Based on the effectiveness of these mitigation measures, water quality will be maintained at a level that protects beneficial uses and supports the propagation of fish and other aquatic species.

Typically, herbicide treatment areas are a substantial distance from water bodies. For example, a review of herbicide treatments applied on the Bradford Ranger District between 1999 and 2001 indicates treatment area boundaries were located at least 100 feet from perennial streams. Forty-eight areas (98% of those reviewed) were located at least 200 feet from any perennial streams. Seventy-three percent of treated areas on the District, during this time, were at least 1,000 feet from any perennial streams. Springs, seeps, and any wet areas, at the time of herbicide application, are buffered through forest plan standards and guidelines. Onsite inspector monitoring helps to ensure that treatment occurs as planned and appropriate mitigation measures are implemented. Herbicide effectiveness has been monitored in past treatment areas through tree seedling stocking surveys and vegetation examinations.

1986 Forest Plan standards and guidelines have also been found to be effective at protecting stream water quality from fertilizer contamination (USDA FS 1994). From a water quality standpoint, a fertilization project was monitored on the ANF in 1991 to determine if a buffer strip was adequate to prevent the movement of fertilizer from a nearby treatment area into an adjacent stream. During the project in 1991, a buffer of approximately 150 feet was maintained between

the fertilizer unit and a nearby stream. The results of the water quality analysis showed low levels of nitrate-nitrogen and total phosphate throughout the sample period (including the pre-treatment), indicating adequate buffering. For this project the fertilizer was applied aerially. Fertilizers are now applied using ground-based equipment only. A buffer of 50 feet around flowing water will meet or exceed buffers used in Pennsylvania and prevent direct application of chemicals on streams. A study performed on the Fernow Experimental Forest in West Virginia shows that nutrient loss can be minimized by applying rates based on soil nutrient deficiencies and avoiding application before rain storm (Edwards et al. 1991). The ANF follows these guidelines and applies fertilizers during the growing season for rapid vegetation utilization, so minimal impact is expected to water uses.

When an effect to a groundwater-based public water supply is possible from actions proposed by the ANF, an evaluation will be done at the project-level as part of the NEPA process, and mitigations and BMPs will be followed to protect these sources. The types of herbicides used and the application rates pose negligible risk to drinking water supplies (see Appendix G1). Based on the limited mobility of both herbicides and limited persistence in ANF soils, there is expected to be no likelihood of ground water contamination from glyphosate (page G1-44) or sulfometuron methyl (pages G1-104 to 106). The water buffers in the LRMP, which are listed in Section 2100-Environmental Management: Pesticide Use, have been evaluated using conservative data and are effective at protecting human health (pages G1-42 to 47, G1-104 to 108, G2-55 to 59, and G2-67 to 70). Therefore, activities proposed in the LRMP will not have an impact on municipal watersheds because there are sufficient standards and guidelines to protect these watersheds.

Road construction

Sediment is the principle pollutant associated with forest management practices and is generally caused by the construction and use of logging roads, landings, and skid trails (Phillips *et al.* 2000). The Forest Wide Roads Analysis Report (USDA FS 2003b) discusses current conditions of roads and also provides additional detail of effects to water quality from roads. Based on forest monitoring of hydrologic connectivity of roads and streams, it is assumed that roads within 300 feet of streams have the greatest risk of contributing pollutants. Indirect effects of timber harvesting on water quality may include an increase in sediment delivery to streams associated with road use during the hauling of harvested timber. Where streams are close enough to a road, airborne particles from heavy truck traffic can be blown from the road into the water and runoff from roads and ditches can carry sediment to the streams if erosion occurs. To reduce the risk of sedimentation to nearby streams, limestone surfacing is generally placed on system roads and road segments within 300 feet of streams (Trieu 1999, Swift 1984). Construction of new roads, addition of existing corridor, and maintenance of existing roads will be designed to meet the water resource guidelines, particularly where roads are within 300 feet of streams or within wetlands management zones. This will minimize the amount of roads hydrologically connected to streams and wetlands and reduce sedimentation.

Stream crossings, wetland crossings, and the approaches of roads to these areas are the source of the majority of sediment contribution to streams and wetlands (Swift 1988). New water resource guidelines direct the avoidance of these areas first, but also address the proper design of roads for crossing streams and wetlands where they can not be avoided.

Alternative logging methods such as full-suspension and helicopter logging can reduce potential soil disturbance and sedimentation associated with conventional methods. Selection of these methods could be made at the project level. These methods will reduce impacts in areas where steep slopes or wet soils prohibit conventional methods.

Construction of roads or other facilities in riparian areas can also affect stream temperatures. Most new facilities will be constructed outside riparian areas, as described in management guidelines, with the exception of stream crossings. Some localized reduction in forested riparian areas will occur at new stream crossings, but the overall effect on stream shading and water temperatures will be minimal.

Decommissioning of roads near streams and wetlands will decrease sediment reaching these areas once vegetation has recovered.

Recreation

Effects on water quality from recreation trails are correlated to effects on soils. Erosion results in increased sedimentation into streams and wetlands when it occurs close to the water body.

Equestrian use can break down streambanks, compact soils in sensitive wetland areas, and cause sedimentation and nutrient enrichment in streams when trails are used repeatedly or by a large number of riders. A couple of riders using the trail only once may have minimal impacts to water resources. Open riding would permit user-developed equestrian trails, which have been documented to have high impacts on water quality where trails are located on steep slopes near streams and where trails cross streams and wetlands (USDA FS 2003e, p. 51). User-developed trails result in impacts that could be minimized by developing a trail system that follows better design principles, and is constructed to address soil and water concerns. Restricting horse users to designated trails will ensure trails are designed to FS standards and guidelines and avoid concern areas. Also, horse use on existing closed roads will have minimal impacts to streams and wetlands.

ATV/OHM trails can affect water resources and have similar effects as roads. Although the corridor for trails is narrower than for roads and will have greater interception from trees, the type of use that occurs on these trails can generate more fine sediment to streams. The primary sediment source to streams occurs where trails cross streams or where trails are located within 300 feet of streams. In the past 10 years, improvements have been made to trails by relocating sections of trails off of poorly drained soils and away from streams and incorporating improved trail design concepts (e.g. keeping trail grades below 10 percent, surfacing trails with limestone, using drainage structures in trail corridors, and seasonal trail closures) (USDA FS 2003e, 50-51). Sedimentation can occur

when surfacing and trail drainage are not maintained. The ATV/OHM trail capability model was used to minimize effects to water resources by placing IUAs in areas with low likelihood of wetlands and steep slopes.

Unauthorized use of ATV/OHMs and user-developed trails cause the most degradation to streams when users cross streams with unstable banks and bottoms, create ruts and compaction in floodplains and wetlands, and ride on steep slopes. A study of the effects of ATV trails on stream characteristics was completed on the Ouachita NF where ATVs have designated trails and have also developed a network of unauthorized trails. Results indicated that embeddedness, percentage of sands and fines, and pool-depth parameters had declined and had significant pool-volume decreases as compared to reference streams (Chin *et al.* 2004). It was not determined what caused the degradation, but the undesigned trails and lack of stream crossing structures are suspected.

Stream crossings will also be avoided. Where they are installed, crossings would have similar effects and mitigations to those discussed for roads in the water quality and water quantity sections. Most new stream crossings would only occur at 1st or 2nd order streams, or other streams that do not show on USGS topographic maps.

With proper planning, design and maintenance, recreation opportunities such as camping and hiking can be provided with minimal impacts to water quality and riparian condition (USDA FS 2003e, 43). Most ANF trails and campsites have very little impact to water resources. User-developed trails and campsites often cause the most resource damage because they do not consider impacts to water resources. Heavy use along streams or wetlands can compact soils, weaken stream banks, and destroy vegetative cover. Fishing pressure on high-use streams also affects streambank conditions and damages vegetation which can affect water quality. There are no foreseeable future plans to develop any large-scale recreation facilities, but if this is proposed it will be analyzed at the project level. Construction or reconstruction of developed facilities or rehabilitation of dispersed sites will not vary by alternatives..

Water quantity

Vegetation management

Vegetation management on the ANF should not measurably change the water quantity in any of the 15 watersheds because treatments will be planned and analyzed at the project scale to avoid cumulative effects. Studies from several areas of the Northeastern U.S., including the Leading Ridge Watershed Research Unit in Pennsylvania, provide an understanding of how forest disturbance influences water yield over time. This research, summarized by Hornbeck *et al.* (1993), identifies three generalizations relative to water yield change. These include the following:

1. Initial water yield increases can occur following forest cutting, with the magnitude being roughly proportional to the percent reduction in basal area;

2. Water yield increases can be prolonged for an undetermined length of time by controlling natural regrowth; otherwise they diminish rapidly to predisturbance levels within three to ten years; and
3. Changes in water yield also respond to changes in species composition.

A study in central Pennsylvania demonstrated that hydrologic recovery takes approximately 4 years (Lynch and Corbett 1990). Reductions in basal area that approach 25 percent were found to have measurable increases in annual water yield (Hornbeck and Kochenderfer 2000). On the ANF, 8 percent of forested land (Table 2-3) is in the 0 to 20 age class which has resulted from natural disturbance and scheduled timber harvest. Since water yield effects decrease after 3 to 10 years, it can be inferred that less than 5 percent of the land is in 0 to 10 age class and stream flows have not had measurable increases. If changes in water yield do occur, it will most likely occur in small headwater areas and effects should dilute as the watershed size increases. Annual increases in water yield due to timber removal are largely a result of increases in summer low flow, as opposed to peak flows, and occur primarily during the growing season (Megahan and Hornbeck 2000). It is assumed that watersheds on the ANF respond to forest disturbance in a similar manner as presented in the preceding studies from across the northeast.

Streamflow changes may also occur from natural processes, diseases, or infestations. Increases in streamflow have been observed in watersheds made up of old growth (this study defined old growth as older than 125 years, Hornbeck and Kochenderfer 2000), although it is unclear how much of an increase will occur. Forest health conditions also have the potential to create changes in streamflow from the large-scale beech die-off and potential impacts to hemlock. Maintenance of conifer component is important to streamflow because they have greater interception and transpiration rates than hardwoods (Hornbeck *et al.* 1993), and they primarily occur in riparian areas. Wind storms also have the potential to affect large portions of forest cover in watersheds, and may cause streamflow increases.

Road construction and decommissioning

The streamflow regime has likely been modified by the presence of roads and other compacted areas on the landscape. These areas have the potential to alter surface and subsurface flow patterns and have a longer-lasting effect where hydrologic connectivity exists between road drainage and the stream network. Wemple *et al.* (1996) found that road segments hydrologically connected to the channel network in Oregon increase flow routing efficiency that may be observed as increases in peak flows. Therefore, it is likely that the streamflow regime has been modified by the presence of the road network and these modifications are likely to appear as increases in peak flow magnitude and decreases in response time. Such changes in the streamflow regime can result in channel modification where channels are susceptible to such influences. Water resource guidelines will reduce impacts to surface and subsurface flow patterns by providing direction for road design and maintenance.

In addition to changes in natural drainage from roads, installation of stream crossings can affect channel morphology and streamflows, and can affect migration of aquatic species. Road crossings can influence stream channels by delivering sediment and other pollutants to the drainage network, by constricting channel widths and floodplain functions, by modifying the movement of water, wood, organic and inorganic sediments, and by modifying the movement and passage of aquatic organisms. Variables that affect the level of influence road crossings have on stream channels and their biota include the type of crossing, the width of the crossing relative to the bankfull width of the channel, the stability of the channel above and below the crossing, the level of road use, and the frequency of drainage structures on the road. Stream crossings, especially culverts, often constrict the natural width of the channel, which can create areas of deposition upstream of the pipe, restrict the movement of wood and sediment through the pipe, and increase channel scour below the pipe. LRMP guidelines are in place to minimize the number of stream crossings for new construction, design for adequate passage of flood flows, and allow for fish passage. Maintenance of existing roads and addition of existing corridors to the Forest system will bring existing stream crossings up to new LRMP standards and guidelines. Although these guidelines will be used for design of road crossings to minimize effects to streams, some effects may occur if crossings are not designed properly.

Where roads are decommissioned at stream crossings, streams banks and their associated floodplains will be restored to natural conditions and allow for the passage of flood flows. Decommissioning of roads near streams and wetlands will also decrease runoff from roads and allow for more water to infiltrate into the groundwater.

Riparian corridors

The riparian corridor will serve as a buffer between management activities and streams and reduce effects to water quality and water quantity (Hornbeck and Swank 1992). By conserving conditions in the riparian corridor, streams with forested habitat will have a supply of organics and maintain water quality. To ensure riparian areas continue to have forested cover and supply of organic material over the long-term, some harvesting in the riparian corridor is proposed. This harvesting has the potential to disturb soils, riparian dependent species, and impact water quality. Standards and guidelines for soil and water resources, including riparian corridors and wetland management zones, are designed to minimize these impacts and keep sediment out of streams and wetlands. Within these areas, forestry activities are less intense and greater attention would be given to maintaining an intact forest floor (Stuart and Edwards 2000). These potential effects are discussed in the previous Vegetation Management section. Effects to riparian areas from roads are discussed in the previous Road Construction section and motorized trails are discussed in the recreation section. The vegetation management activities in riparian corridors will not create new roads. These treatments will utilize existing roads.

Treatments proposed in the riparian corridor include uneven-aged and two-aged treatments that will promote vegetation composition and structural diversity, and even-aged treatments to sustain aspen. Maintaining an even delivery of large wood and providing a mix of riparian species can be achieved by manipulating vegetation stand structure and composition (Richards and Hollingsworth 2000). Some salvage will be permitted within riparian areas where reforestation is needed due to insect infestation,

disease, plant interference, or other natural disturbance. Salvage or harvest will not be permitted when trees are needed for the health or maintenance of riparian values of stream channels, wetlands, or floodplains. Thinning treatments could also include introducing unmerchantable and merchantable trees into the stream channel and riparian area to improve complexity of fish habitat, trap sediment, retain organic matter, and reduce flow velocities (Richards and Hollingsworth 2000).

Where herbicide treatments are needed for reforestation of riparian corridor treatments, stand activity would adhere to herbicide buffers. Effects of herbicides on water resources are discussed in the reforestation treatments section. Herbicides would also be used to control the spread of non-native invasive species (NNIS) in riparian areas. These effects are discussed in more detail under the previous herbicide section and Appendix G. Herbicide use would help increase the diversity and abundance of understory plants and tree seedlings (Ristau *pers. comm.* 2005).

Avoiding all vegetation management activities in riparian corridors could promote plant interference, limit seedling development in these areas, or encourage the establishment of short-lived species (see Canopy Gaps and Interfering Plants, p. 3-127). The forest health concerns addressed in the vegetation management section are also present in riparian corridors. Some management in these areas will promote a diversity of vegetation composition and structure and maintains forest cover. It can also allow for management to occur in areas affected by insect infestation, disease, native or non-native plant interference, or other natural disturbance. Silvicultural techniques would help accelerate the development of late structural characteristics in riparian corridors (see Most restoration of old growth..., p. 3-143), which would allow for the recruitment of large wood into the streams well into the future (Richards and Hollingsworth 2000).

Prescribed fire

Prescribed fire is generally used to reduce ladder fuels and restore or maintain desired vegetative conditions. In these circumstances, fire intensity, severity, and scale are generally lower and smaller than wildfire events. Control and containment features such as dug fire lines can result in ground disturbance, but the level of prescribed fire activity using dug firelines is relatively minor and the potential effects are negligible. The nature of prescribed fire on the ANF (see 2400 Vegetation Management section) does not produce large-scale watershed, riparian, or aquatic disturbances. If prescribed burn plans are followed and low-intensity burns occur as planned, then the effects will be minimal and temporary.

Watershed improvements

There is a broad range of efforts to restore watershed conditions across the ANF, such as protecting and restoring riparian areas, road obliteration projects, bank stabilization projects, and other efforts to revegetate and stabilize exposed soils. In the course of implementing these projects, ground disturbance and, to a lesser extent, vegetation impacts will occur. The intent is to minimize the short-term effects to correct long-term problems. Generally, most improvements are relatively small and localized, and have a minor effect on soil loss, sedimentation, and vegetation. These projects have the beneficial effect of reducing erosion and sedimentation over the long term. Additional mitigation such as seeding and mulching can ameliorate the short-term effects from sediment until soils are stabilized.

Opportunities for watershed restoration are typically identified during watershed assessments, project planning, and inventory and monitoring activities. These efforts are not likely to change between alternatives, although watershed restoration opportunities within MA 5.2 may be limited by the potential for wilderness designation.

Fish and wildlife habitat improvements

Fish and wildlife habitat improvement projects include activities such as the creation and maintenance of savannahs, instream habitat structure, and wildlife openings and their access roads. Implementation of these projects can result in vegetation impacts and ground disturbance in varying degrees depending on the scope of the project and site conditions. At a landscape scale, habitat improvement projects treat a minor part of the analysis area and the potential benefits and impacts are best analyzed at a localized scale.

Facilities and structures

A broad array of physical developments and structures, such as administrative facilities, utility developments, and communications sites authorized under special use authorizations have both short-term and long-term effects on water (e.g. construction, site clearing, and soil disturbance). Special use corridors that cross stream channels can have direct effects on riparian vegetation and water quality. These effects vary depending on the scale and nature of the development, as well as the setting. Road construction for installation and/or maintenance purposes can contribute to the impacts from the facility. In general, once an area is committed to a facility or structure, there is a permanent commitment of resources. Proposals will be analyzed on a case-by-case basis at the project level. No estimates are made by alternative for this analysis.

Effects from each alternative

The area that can be potentially harvested, acreage harvested annually, acres of herbicides and fertilizers, the miles of roads constructed or decommissioned, acres of riparian corridor treatments, acres of IUAs, and acres of EUAs can be used to compare alternatives and the potential effects to watershed and riparian resources.

Under Alternatives B, Cm, and D it is anticipated that water and riparian conditions will be protected. Alternative A will have slightly less restrictive standards and guidelines for perennial streams and floodplains, but will most likely achieve adequate protection. The 1986 Forest Plan, as amended, provides a streamside buffer of perennial and intermittent streams of 50 feet plus additional distance for slope. For Alternatives B, Cm, and D, the riparian corridor is increased on perennial streams to 100 feet and a 200 foot riparian corridor is established around Wilderness Trout streams, Remote Trout streams, and Class A streams. There would be some harvest that would be allowed within the riparian corridor to meet LRMP 2500 watershed objectives. These alternatives also provide more direction for protection of springs, seeps, vernal pools, and other wetlands. This includes a limited treatment zone of 100 feet around wetlands, springs, and seeps, and 200 feet around vernal pools. This increase in design criteria should provide increased protection of water quality.

Although standards and guidelines do not completely eliminate water quality and riparian impacts, they will reduce impacts to acceptable levels. Since ANF standards and guidelines will meet or exceed Pennsylvania DEP BMPs, they will meet the goals of the Clean Water Act.

Suitable acres by watershed

The location of the potential harvest activity is defined as the suitable lands within management areas that allow harvest activities (Table 3-9). Management areas that permit a greater level of management activity, such as road construction and timber harvesting, are considered to have a greater potential to disturb watershed, riparian, and aquatic conditions than those that limit management actions and emphasize wilderness or remote areas. The management areas that allow timber management activities vary by alternative (see management area descriptions in Chapter 2).

Not all of the acres located within the management areas are available for timber harvest. A number of acres have been removed from the suited timber base due to suitability issues, or to protect other resources such as Wilderness Trout and Remote Trout Streams. The remaining acres within the management areas are considered to be the suitable area for timber management.

Using GIS, the suitable lands for each alternative were evaluated against 5th level watersheds to identify what watersheds are potentially affected and to calculate the acres of suitable lands within each watershed. The assumption is that watersheds with a large percentage of harvesting will have more potential for watershed, riparian, and aquatic effects to occur. Table 3-9 displays the acres considered suitable for timber management within each 5th level watershed within the proclamation boundary by alternative.

Overall, all watersheds in all alternatives have some amount of suitable acres for harvest. Alternative D has the fewest acres of suitable timber management acres and Alternative A has the most. Alternatives B and Cm fall in between the other alternatives. Table 3-9 shows that the percentage of ANF suitable lands in watersheds within the proclamation boundary is well distributed. At least 9 percent of all watersheds are considered unsuitable for timber harvest.

An analysis was also completed of the percentage of suitable lands in MA 3.0 per watersheds. Alternative B has the greatest amount of suitable acres in MA 3.0 and Alternative D has the least. The percentage of suitable lands in MA 3.0 is also well distributed, with the exception of Brokenstraw Creek which does not have any MA 3.0 in any alternative and Reservoir watershed which does not have any MA 3.0 in Alternative D. Therefore, effects to water quality and water quantity will be minimized by distributing projects throughout most watersheds.

Table 3-9. Watersheds and percentage of land suitable for timber management in watersheds within the proclamation boundary

Watershed Name (HUC 5)	Watershed Acres within the proclamation boundary	Percent of Watershed in FS ownership	Percentage of NFS land suitable for timber management in watersheds within the proclamation boundary			
			Alt. A	Alt. B	Alt. Cm	Alt. D
Brokenstraw Creek	407	0.2	57	53	53	53
Clarion R. (Lower)	43,454	30.1	80	78	78	78
Clarion R. (Upper)	61,062	52.2	83	70	70	70
Kinzua Creek	91,301	58.3	83	83	83	73
North Allegheny Front	25,699	30.4	74	73	73	70
Reservoir	70,124	41.7	62	62	54	49
South Allegheny Front (Lower)	58,300	45.0	65	63	58	58
South Allegheny Front (Upper)	28,715	24.0	40	32	32	32
South Branch Tionesta Creek	53,164	71.4	78	78	78	78
Spring Creek	56,094	70.7	87	87	87	87
Tionesta Creek (Lower)	71,158	40.1	87	87	87	71
Tionesta Creek (Upper)	66,384	75.5	89	82	75	71
Tunungwant Creek	13,927	5.9	84	84	84	84
West Branch Clarion River	17,101	11.6	67	57	57	57
West Branch Tionesta Cr.	83,879	51.9	90	91	86	82

Potential harvest activity (acres)

A major vegetative management objective is to provide better distribution of forest age classes, and timber harvesting is the primary tool to achieve the objective. Table 2-2 displays the potential annual average harvest activities by alternative. These numbers are used for the relative comparison of alternatives, and are based on full implementation of the alternative.

The potential effects on watershed and aquatic conditions will depend on how the harvest activity is distributed in the suitable areas, the volume of timber harvested, and the logging methods used. Alternatives that effect fewer acres have a lower risk of impacting watershed, riparian, and aquatic conditions. Vegetation management method will also affect these conditions depending on the number of entries, as discussed in vegetation management effects. Even aged treatments will be at least 3 times higher in Alternatives A, B, and Cm than Alternative D. Alternative D features uneven-aged treatments, although Alternatives B and Cm actually have higher levels of uneven-aged treatments in the early decades. The total average annual harvest is lowest in Alternative D and highest in Alternative A (Table 2-2). Over a 10-year period, there is maximum potential for harvest treatments to occur on 8 to 9 percent

of the suitable acres for Alternatives A, B, or Cm and there is potential for harvest treatments to occur on 3 percent of suitable acres for Alternative D.

Changes to streamflow regime are not expected from vegetation management when considering the amount of harvest that will occur in a 10-year period. Forest harvesting does not generally increase flow if less than 25 percent of the basal area of the watershed is harvested within a 10-year period (Hornbeck *et al.* 1993). Following this research, increases in flow should only be recognized in small watersheds during low flow periods, which may benefit aquatic species. Since past harvesting levels are similar to levels proposed in Alternatives A, B, and Cm, no measurable changes in streamflow should occur. Effects from management actions will be much lower than past levels in Alternative D.

Acres of herbicides and fertilizers treatments

Acres of herbicides used for reforestation will be similar in Alternatives A, B, and Cm. These levels will be two times what were used in the past on the ANF and levels proposed in Alternative D. Herbicide use in Alternatives A, B, and Cm would increase because the level of regeneration harvests is increasing about twice as much as past levels. Acres of fertilizers used for reforestation will be highest in Alternative A and lowest in Alternative D, with Alternative A using nearly half what was used in the past, and Alternative D is about 1/3 what is used in A.

In Alternative A, glyphosate and/or sulfometuron methyl would continue to be used to help control primarily fern, grass, striped maple, and beech brush using either backpack foliar or mechanical ground foliar application techniques. 1986 Forest Plan buffer widths would be used (USDA FS 1986b, Chapter 4, p 24): a 75-foot buffer along perennial streams, lakes, impoundments, and intermittent streams flowing water on the day of treatment; a 50-foot buffer along intermittent streams not flowing water and spring seeps that drain into a stream; and a 25-foot buffer around small seeps with no outflow.

In Alternatives B, Cm, and D, glyphosate and sulfometuron methyl would be applied to vegetation using backpack foliar, cut surface, or mechanical ground foliar application techniques to achieve a wider variety of resource management objectives. For the lower application rates using the mechanical ground foliar application technique, the buffer width would be 25 feet along perennial streams, lakes, impoundments, springs, seeps, and intermittent streams containing water on the day of treatment; and 10 feet along dry intermittent streams, springs, or seeps. For backpack foliar and cut surface treatments, no herbicide would be applied within 10 feet of standing or flowing water. Within 10 feet of an intermittent stream course not flowing water, only the cut surface treatment would be used, and these treatments would not be used within the channel.

Although buffers in Alternatives B, Cm, and D are narrower than in Alternative A, less than 4 percent of herbicide treatments for reforestation would occur inside the riparian corridor. Inside the riparian corridor, herbicide treatments for reforestation would be least in Alternative D and most in Alternative B. Also, a small amount of the treatments would occur in the riparian corridor for developing and maintaining certain types of wildlife habitat, scenery enhancements, protecting heritage resources from woody plant damage, and controlling invasive plant species. These treatments would be least in Alternative A and greatest in Alternatives B and Cm. These treatments will help improve vegetation diversity and structure.

The Herbicide Risk Assessment (Appendix G2) has reviewed effects to groundwater and surface water regarding aquatic life and human health water quality criterion and has found that the LRMP standards and guidelines will help ensure that treatment effects meet water quality protection criteria.

Miles of road construction and decommissioning

Road effects to sedimentation and streamflow will vary by alternative depending on the amount that is constructed, maintained, and decommissioned. Roads are considered hydrologically connected when they are within 300 feet of streams; therefore only the mileage within 300 feet of streams will be considered because they have the greatest potential to increase runoff and sedimentation to streams. Table 3-10 shows the total miles of proposed road work that could be completed by 2060 within 300 feet of streams.

Table 3-10. Proposed road work by 2060 within 300 feet of mapped streams (miles)

	Alt. A	Alt. B	Alt. Cm	Alt. D
Existing Corridor	17.3	17.3	17.2	16.6
New Construction	7.1	5.4	4.8	4.3
Decommissioning	0.1	0.1	0.5	2.2

New road construction within 300 feet of streams has the greatest potential to cause changes to current streams conditions. These effects will be greatest immediately after construction and decrease once the road is stabilized (Swift 1984). Alternative A proposes to construct the greatest number of miles within 300 feet of streams and Alternative D proposes the least by 2060. Existing road corridors that are converted to FS system roads will cause short-term sedimentation during reconstructions, but over the long term, sedimentation could be reduced if road conditions are improved because of FS standards and guidelines. Alternatives A and B convert the most non-system roads to system roads within 300 feet of a stream, but the mileages do not vary much between any alternative. In addition to roads within 300 feet of mapped streams, roads will also be constructed, or existing corridor will be upgraded, near first and second order streams in proportion to the miles of activity in each alternative. These streams will be identified and avoided where practical during project planning. Road decommissioning will also cause short-term sedimentation, but it will create the greatest long-term benefits where natural drainage and vegetation cover are restored. Alternative D decommissions the most miles of roads within 300 feet of streams. It is expected that more roads will be decommissioned as soil and water improvements are identified during project-level analysis. Overall, Alternative D will have least effect on water resources from roads.

The distribution of the proposed road network within watersheds in 2060 was also evaluated. Conversion of non-system roads to system roads and new road construction is proposed in all watersheds for all alternatives. The proposed conversion of non-system roads remains close to the same for each watershed in all alternatives so there will be very little comparative difference between alternatives. Alternative A proposes at least 25 percent more roads than the other alternatives in 9 of 15 watersheds. Alternative B proposes at least 25 percent more roads than Alternative D in 7 of the 15 watersheds. For the rest of the

watersheds, the proposed new road construction will not vary more than 25 percent between alternatives. Alternative D will cause the least effects to the 15 watersheds and Alternative A will cause the greatest.

Effects to wetlands, springs, seeps, and vernal pools are also possible from the construction of new roads or the conversion of non-system roads. Wetland management zone guidelines will direct the layout of roads to avoid wetlands, springs, seeps, and vernal pools. Proper road design will also avoid changes to surface and subsurface flow.

Riparian corridors

The direction for management in the riparian corridor will vary by alternative. Alternative A (1986 Forest Plan) has no direction for direct management of the riparian corridor, but allows for such treatment. Roughly 95 acres of vegetation management will be expected to occur per year. The LRMP has set objectives to manage 50 to 100 acres of the riparian corridor per year. The objective for this management is to restore compositional and/or structural diversity to riparian corridors. Vegetation management in the riparian corridor will be implemented following new Forestwide standards and guidelines for Alternatives B, Cm, and D. This direction is designed to minimize possible effects to water quality, streamflow, aquatic habitat, and riparian-dependent species. Alternative A will have slightly less restrictive standards and guidelines. Uneven-aged and two-aged treatments in the riparian corridor would be designed to avoid warming stream temperatures and to provide an intact filter strip.

Of the 57,039 acres of riparian corridor, less than 35,000 acres are suitable for timber harvest in any alternative. Alternative A has the greatest amount of riparian corridor in the suitable land base (34,500 acres) and Alternative D has the least amount in the suitable land base (30,500 acres). Alternatives A, B, Cm, and D propose treating 3 percent or less of the suitable acres within the riparian corridor with prescribed uneven-aged and two-aged treatments each decade. Alternative A would treat the largest number of riparian acres annually; Alternative D would treat the least (Table 2-2). This minimal level of harvest will allow for accumulation of large wood into streams, protection of water quality, and protection of riparian-dependent species. Alternatives A, B, and Cm have the greatest potential to cause negative impacts to riparian areas from activities within the riparian corridor, while Alternative D will potentially impact the least. Alternative D will potentially improve the least amount of vegetation condition within the riparian corridors, and the other alternatives will improve the most.

Acres of EUAs

Alternatives A, B, and Cm will have the greatest impact to streams and wetlands because the majority of the ANF will permit open riding. Alternatives B, Cm, and D will provide better direction for the maintenance and control of equestrian use throughout the ANF through the LRMP standards and guidelines. Also, the designation of EUAs around commercial outfitters/guides will help reduce impacts in these areas by keeping horses on designed trails. Alternative D will have the greatest beneficial impact to streams and wetlands because no open riding will be permitted. Alternative Cm will have the next greatest benefit because of the EUAs and the most acres of restricted riding areas, which would reduce sedimentation of streams and wetlands in high-use areas.

Acres of IUAs

While the 1986 Forest Plan, as amended, has direction for the protection of streams and wetlands, Alternatives B, Cm, and D incorporate additional standards and guidelines which will further minimize effects to these resources and protect against degradation of water quality. The location of IUAs in Alternatives B, Cm, and D was also constrained using a GIS model to avoid steep areas and wetlands and reduce impacts to streams. However, some amount of sedimentation will occur from the use and wear of motorized trails in all alternatives. Therefore, the amount of sedimentation will vary by alternative. Alternative B will have the greatest impact to water resources because it proposes to construct the greatest number of trail miles on FS lands, while Alternative D would construct the least.

Cumulative effects

The cumulative effects analysis area for watersheds and riparian resources is the 15 watersheds within the proclamation boundary. These watersheds encompass 1,400,350 acres, but only 740,600 acres will be analyzed. Water quality is believed to be comparable inside and outside the proclamation boundary because the 4-county area has similar forest cover and development rates as within the proclamation boundary. The watershed that is least comparable is Brokenstraw watershed which only has 67 percent forest cover, but only 0.2 percent of this watershed is within the proclamation boundary. The time frame analyzed is from 1990 to 2020.

On the ANF, streams move through several different ownerships; therefore effects from activities on one ownership can be transported to downstream ownerships. To estimate the cumulative effects of the alternatives on watershed and riparian resources, activities on adjacent non-federal lands must be considered. The percentage of FS ownership is a good reflection of the degree of influence FS resource management could have in any particular watershed (Table 3-9). This Table also infers the potential impacts from state and private activities. Many of these watersheds have state-owned lands such as state parks and state game lands which also will be managed for the public's benefit. Within the proclamation boundary, West Branch of Tionesta and Spring Creek watersheds contain a large portion of State Game Lands.

State and federal agencies with regulatory authority aid in the protection of watershed and riparian health during the implementation of activities on public and private that include energy and minerals development, timber harvesting, and housing development. Federal and state programs provide opportunities for private landowners to restore and improve wetland and riparian habitat. For instance, within Warren County the Conservation District is assisting watershed groups, providing public education, and improving riparian condition through streambank fencing. Warren County is in the process of developing a stormwater management plan which will identify and correct stormwater problems from roads and other development. Furthermore, federal and state agencies offer educational opportunities for private landowners to learn BMPs for logging, woodlands management, and riparian management. These programs are providing long-term beneficial effects to watershed health. FS activities such as soil and water improvement, fish habitat structures, and cooperation with watershed groups will also address areas of existing concern and maintain or improve conditions in the 15 watersheds.

Antidegradation requirements in Pennsylvania are designed to protect and maintain the existing water quality of High Quality and Exceptional Value waters, as well as the protected uses for all surface waters (PA DEP 2003). All activities (including new and existing roads, oil and gas development, timber harvesting, and recreation

activities) will be obligated to meet this requirement. Future monitoring and continued enforcement actions by the DEP and the Fish and Boat Commission are necessary to ensure compliance.

Forest Service management activities such as road construction, timber harvesting activities, and recreation activities have the potential to result in sedimentation of aquatic and riparian habitat. In order to accomplish short-term and long-term land management activities, sediment transport may be an unavoidable consequence. However, Forestwide standards and guideline integrated into all alternatives minimize direct, indirect, and cumulative effects to watershed integrity. These forestwide standards and guidelines not only reduce the threat of short-term impacts, but minimize the likelihood for long-term adverse effects to water resources.

The following cumulative effects discussion for water and riparian resources focuses on management activities that pose the greatest risk to water quantity or water quality. The factors that will be considered include the change in development levels, timber harvesting, and acid deposition.

Development levels

OGM road construction is the greatest impact to water resources from past, present, and predicted future development. Roads are often built with adequate soil and water protections but are not properly maintained allowing sediment runoff to directly reach streams and wetlands. The analysis below highlights the projected future development within the proclamation boundary. To analyze cumulative effects for development levels, the following assumptions were made: 1) housing and commercial development levels are static or only slightly increasing and will not be considered, 2) rates of private OGM development on FS lands are equal to development on private and other public lands, 3) stone pits will have minor effect on water resources and will not be considered because they are located in areas away from streams and riparian areas, 4) motorized trails are only predicted on FS lands.

Roads

Currently there are approximately 1,269 miles of FS road, 2,940 miles of non-system roads and 708 miles of municipality roads within the proclamation boundary. From 1990 to 2005, 135 miles of new road or existing corridor were added to the ANF transportation system and 1,100 miles of private OGM roads were constructed within the proclamation boundary. By the mid-point of the second decade, an additional 69 to 116 miles of potential new FS road will be constructed and 171 to 203 miles of existing corridor will be added to the system depending on the alternative and 1,920 miles of potential new oil and gas roads that will be constructed. There may be a slight difference in water and riparian resources effects between alternatives from the level of new road development. Alternative A will have the largest effect and then in descending order from B to D, but they all will combine with private OGM development and double the magnitude over levels that occurred between 1990 to 2005 (see table 2-4). Where these roads are hydrologically connected to streams in these watersheds and mitigations are insufficient or not maintained, increased runoff and erosion could lead to channel scour, excessive sedimentation, and deposition.

Along with OGM roads, there will be sedimentation and increased runoff to streams and riparian areas from well pads where they are in close proximity to these areas. From 1990 to 2005, it is estimated that 5,000 well pads

have been constructed and the most likely projection is for 7,680 private OGM well pads to be added in the next 15 years (See Appendix F Table F-5).

Pennsylvania BMPs set guidelines for road and well pad construction for developers to control erosion and sedimentation. In order for these BMPs to protect channel condition and water quality, these BMPs must be installed correctly and maintained. In addition to the BMPs, oil and gas operators will also be expected to meet the design criteria of the LRMP on their developments, unless it prevents reasonable access. This is a substantial improvement over the 1986 Forest Plan. In particular, roads and well pads will be expected to avoid riparian corridors and wetland management zones, which will provide an adequate buffer between water resources and development. Crossings of streams and wetlands will be minimized to those necessary to access their subsurface rights. Where sedimentation is likely to cause adverse impacts to streams and wetlands, additional mitigations such as directing runoff to filter strips, installing more frequent cross drains and water bars, and placing limestone on roads would be applied to prevent streams from being degraded. Cooperating with oil and gas operators, a new LRMP objective, would help resolve water resource concerns, improve the layout of roads, and reduce the number of stream crossings needed for development (USDA FS 2004d). It is possible that National Forest management will improve watershed conditions where oil and gas roads are adopted to the Forest Road system and standards and guidelines are applied during project level implementation.

Currently there are no streams listed on the 303(d) list by DEP for sediment delivery from National Forest or OGM activities (PA DEP 2006). If streams are being degraded, the FS will work with OGM operators and PA DEP to control erosion from roads and protect water quality. A stream survey of Salmon Creek watershed was conducted by the PA DEP (2002) to determine effects from an OGM development with BMPs in place. They found that sediment movement into streams appeared to be associated with dirt and gravel roads rather than well pads. These roads were acting as a conduit to quickly move water and some sediment into streams and swales, possibly due to not implementing BMPs correctly. It was noted that scour from sand was the primary mechanism responsible for changing benthic and macroinvertebrate communities. Elevated levels of sediment can also fill necessary interstitial spaces in sediment, reduce available habitat and reduce the algae and bacteria based food supply. This study did not assess the implementation of the BMPs, but recommendations were made to improve runoff problems. Runoff conditions were improved when the ANF reconstructed FR 127 with limestone surfacing (USDA FS 2004g). In addition, portions of FR 165 and FR 631 were surfaced with limestone and stream crossings were improved to reduce runoff into streams. Follow-up is needed to determine if benthic and macroinvertebrate communities have improved. The ANF will continue to work with operators and the PA DEP to comply with anti-degradation requirements.

The watersheds that will have the highest levels of roads in 2020 using the projected trends will be North Allegheny Front, Tunungwant, South Branch Tionesta Creek, Spring Creek, and Kinzua Watersheds, in order from most to least.

Trails

ATV/OHM trails also have potential to add to cumulative effects for water resources where trails occur in close proximity to streams and riparian corridors, but to a lesser extent than roads. Currently there are 108 miles of ATV/OHM trails. From 1986 to 2005, 48 miles of motorized trails have been added to the ATV/OHM trail system. During the life of the LRMP, the greatest number of miles and greatest potential effects are predicted in

Alternative B, followed by Alternatives A and Cm. The least potential impacts are predicted in Alternative D. The trends in development will be expected to increase for B, decrease for D, and remain about the same in A and Cm. New trails and trail relocation will limit stream crossings and avoid riparian areas to minimize effects.

The ANF ATV/OHM trail system may have beneficial impacts to nearby private and public lands, because ATV/OHM use has increased. Providing more opportunity for trail use on developed FS trails may reduce the number of user-developed or illegal trails on private and public lands and decrease sedimentation. When the public uses a fee trail system, the generated funds pay for maintenance of these trails. When the public rides on user-developed trails on public and private lands, the trails can deliver sediment to streams and wetlands if they are located in close proximity.

Timber harvesting

Water resource effects will be possible from timber harvesting levels on ANF, other public, and private lands. From 1990 to 2005, ANF vegetation management has occurred on approximately 65,200 acres and 19,100 to 53,900 acres are expected to be harvested in the next 15 years on ANF land. Additional vegetation management has occurred on private or other public land within the proclamation boundary since 1990 and more is expected in this period on private and other public land (see cumulative effects section in 3.3.1 Forest Vegetation for estimates). These levels of vegetation management should not cause measurable increases in streamflow. Harvesting near these streams and riparian areas has some potential for effects to these resources, although no adverse cumulative effects are expected. On the ANF, streams and wetlands will be protected through standards and guidelines and on private and other public lands these resources should be protected where Pennsylvania BMPs are followed. Considering the forest health concerns that exist on the ANF, vegetation management will be critical in maintaining a forested condition in watersheds because forest cover maintains water quality and quantity.

Acid deposition

There is uncertainty over the cumulative effects from acid deposition on stream systems. This could affect water quality of streams by causing further decreases in acid neutralizing capacity and pH. Currently within the proclamation boundary, there are two streams listed on the 303(d) list for low pH from natural sources (PA DEP 2006). Further monitoring of pH and acid neutralizing capacity is needed to determine trends. If streams are acidified due to acid deposition to a point where they no longer support aquatic species, treatments may be needed to be evaluated to improve water quality. At the level which timber harvesting activities are occurring on public and private lands, loss of soil nutrients are not expected to cause cumulative effects to stream acidity (Baldigo *et al.* 2005). Effects from acid deposition are discussed in more detail in the air section.

3.2.4 Air resources

A few changes were incorporated in the air resources portion of Chapter 3 between Draft and Final EIS. These changes were incorporated to address items the public commented on and incorporate applicable new science that became available between Draft and Final EIS. The emissions tables were updated to show the changes in alternatives from draft to final. A discussion on carbon monoxide was added.

Affected environment

The Clean Air Act Amendments (CAAA) of 1977 established the prevention of significant deterioration (PSD) program. These amendments designated specific wildernesses and national parks as class I areas. The ANF does not have any class I attainment areas. Class I areas are larger national parks and wilderness areas in existence in 1977, and include eight areas in the Eastern Region of the FS but none within 200 kilometers (about 125 miles) of the ANF. New areas may be designated as class I only through actions taken by the Governor of Pennsylvania. When looking at the impacts of air quality on ANF resources, it is important to keep in mind that only a handful of pollutants contribute to a variety of air quality related issues. These pollutants are a concern because of their impacts to both human health and ecosystems, and are described in detail below. Air pollutants are generally classified as either primary or secondary pollutants. Those emitted directly to the atmosphere as products of combustion are classified as primary pollutants, and those formed when primary pollutants undergo atmospheric chemical reactions are secondary pollutants.

Sulfur dioxide

About 69 percent of sulfur dioxide released to the air (11.2 million tons in 2000), comes from electric utilities, especially those that burn coal (US EPA 2003, p.2). Other sources of sulfur dioxide are industrial facilities that derive their products from raw materials, like metallic ore, coal, and crude oil, or that burn coal or oil to produce heat. Examples are petroleum refineries, cement manufacturers, and metal processing facilities. Also, locomotives, heavy marine equipment, and some non-road diesel equipment currently burn high-sulfur fuel and release sulfur dioxide in large quantities. Once sulfur dioxide is emitted into the atmosphere, it undergoes chemical transformations to form secondary pollutants such as sulfates and sulfites. In the Eastern United States, these secondary sulfur pollutants are the major contributors to visibility impairment and acidic deposition.

Monitoring data compiled by the United States Environmental Protection Agency (US EPA) shows that the Eastern Region receives 57 percent of the nation's sulfur dioxide (sulfur dioxide) emitted from point sources. There are eight facilities within 200 km (125 miles) of the ANF that produce in excess of 100,000 tons of sulfur dioxide per year, and dozens more that produce in excess of 250 tons of sulfur dioxide per year. As a result of the 1990 amendments to the Clean Air Act, sulfur dioxide emissions have been reduced (Driscoll *et al.* 2001, p.183). From 1983 to 2001 deposition of hydrogen ions (an indication of acidity), sulfate, nitrate, and ammonium is estimated to have been significantly reduced (Lynch, Horne, and Grimm 2003, p.58-59). The ANF is near one of the largest sulfur dioxide emitters in the country, and the resulting acidic sulfate deposition is among the heaviest in the nation.

There are two National Ambient Air Quality Standards (NAAQS) standards for sulfur oxides. There is a 24-hour average of 0.14 ppm that is not to be exceeded more than once a year. The second standard is an annual average of 0.03 ppm.

Sulfur dioxide and acid deposition

Acid deposition occurs when acidic compounds in the atmosphere are deposited on the earth's surface through rain, clouds, snow, fog, or as dry particles. These acidic inputs can contribute to degradation of stream water quality and decrease the amount of available base cations in the soil substrate. An ecosystem's susceptibility to soil nutrient losses and decreases in stream water acid-neutralizing capacity are influenced by many factors, most notably the bedrock geology/lithology types and the level of acidic inputs.

The bulk of acid deposition on the ANF is the result of sulfur dioxide and nitrogen oxide emissions near the ANF, and to a great extent, transported from the Ohio River Valley. At a broad-scale, most of the ANF is at risk for acid deposition based on the soils and geology of the area which contain very few neutralizing cations or base cations, such as calcium and magnesium. Specifically at greater risk of acidification are the plateau tops, shoulders, and upper side-slopes. These areas receive little to no input of groundwater. This groundwater may seep through calcium-rich rock layers and carry these base cations to the surface in lower side-slopes, foot-slopes, and valley bottoms (S. Horsley, pers. comm., 02/2004).

Downward trends in sulfur dioxide emissions and sulfate deposition are predicted to have a positive effect on aquatic and soil resources on the ANF; however, the reductions are likely not great enough to reverse the degradation that has already taken place.

Sulfur dioxide and regional haze

During the last four decades, the Eastern United States has seen a significant regional reduction in visibility, brought on by a corresponding increase in ambient levels of visibility-impairing pollutants often referred to as fine particulates (Malm 1999, p.38-41).

Monitoring of atmospheric particulates and other impairments of visibility suggest that the average visual range on the ANF is approximately 40 miles. This is a significant level of impairment considering natural visibility in the East is estimated to be between 60 and 80 miles. The reduction in visibility is primarily due to particulate matter in the air including sulfate, nitrates, soot, organic carbon, and soil. Ammonium sulfates, stemming from the emission of sulfur dioxide, are responsible for 60 to 90 percent of the visibility impairment across the Eastern United States and Canada.

Nitrogen oxides

More than 95 percent of nitrogen oxides emissions are in the form of nitric oxide. The primary sources of nitrogen oxide emissions are electric utilities, primarily coal powered and the transportation sector. Smoke from wild and prescribed fire is also a contributor to nitrogen oxide production, and is a concern for Federal land managers. However, it should be noted that thermal nitrogen oxide production increases with increased burn temperature. Relatively low-temperature prescribed burns emit very little nitrogen oxide as compared to wildfires.

Secondary pollutants formed from nitrogen oxides such as nitrates also reduce visibility and contribute to acid deposition. In the presence of volatile organic compounds (VOCs) and sunlight, nitrogen oxides rapidly contribute to the formation of ozone. Available evidence suggests that nitrogen oxides are a controlling factor in the formation of ground-level ozone in rural areas of the Southern United States (Chameides and Cowling 1995, p.75). Monitoring data compiled by the US EPA shows that the Eastern Region receives 45 percent of the nation's nitrogen oxide emitted from point sources. The highest concentrations of nitrogen oxide sources are well south of the ANF, but the ANF is still surrounded by numerous nitrogen oxide sources. The NAAQS Standard for nitrogen oxides is an annual mean of 0.053 ppm.

Ozone

Ground level ozone (O_3) is a secondary pollutant, and its production is highly dependent on the presence of nitrogen oxides and volatile organic compounds in the right ratios, sunshine, and elevated temperatures. Therefore, high ozone levels will occur only during periods of warm weather, plentiful sunshine, and high levels of ozone-forming pollutants. For this reason, the ozone monitoring season extends from April to October. It is important to note that there are two locations in the atmosphere where ozone occurs; the stratosphere (upper atmosphere) and the troposphere (ground level). Although the presence of ozone in the upper atmosphere is highly beneficial, in sufficient doses at ground level, ozone is considered a free radical, capable of killing living tissue in plants and in the human lung. Ozone's harmful effects are due to the pollutant's chemical make-up.

The compound ozone is composed of three oxygen molecules, and is less stable than diatomic oxygen (the oxygen our bodies need). This unstable molecule reacts with the tissues inside the leaf of a plant, sometimes causing the death of those tissues. This same ozone radical also reacts with tissues in the human lung, causing inflammation and respiratory ailments, and, in extreme cases, premature death.

The NAAQS standard for ozone is set at levels considered protective of human health; however, damage to plants occurs at levels below the NAAQS standard for ozone. The ozone standard for human health is set at 0.085 parts per million (ppm) for a rolling 8-hour average. Monitoring of plants susceptible to ozone injury has shown only minimal damage to one species, but there is still concern over effects of ozone on the ANF.

Particulate matter

Particulate matter (PM) refers to any suspended atmospheric particle and is comprised of many different elements or compounds. It is defined based on various size classes of the particle's aerodynamic diameter, i.e., particles with an aerodynamic diameter of 10 microns are referred to as PM10 and particles with an aerodynamic diameter of 2.5 microns are referred to as PM2.5. Particulate matter can be either a primary or a secondary pollutant, both of which affect ANF resources.

Primary particulates tend to be larger in size, and are directly emitted from a combination of sources including combustion sources, agriculture, and road construction. Secondary fine particles are formed when combustion gases are chemically transformed into particles. The bulk of regional fine particles within the analysis area are the result of these chemically-transformed combustion gases, such as sulfates and nitrates; mainly sulfate particles (transformed sulfur dioxide) from coal-fired power plants. These smaller, chemically-transformed fine particles are largely responsible for regional haze.

There are NAAQS standards for only one size class of fine particulates, PM_{2.5}. The PM₁₀ standard has been revoked by the US EPA, effective December 17, 2006. The PM_{2.5} is the standard of concern, since particles with a diameter of 2.5 microns or less have a greater ability to impair visibility and impact human health. The NAAQS standard for PM_{2.5} is a 24-hour average of no greater than 65 micrograms/m³, or an annual arithmetic mean of no more than 15 micrograms/m³. A new NAAQS standard for PM_{2.5} is a 24-hour average of no greater than 35 micrograms/m³ will be implemented in 2013.

Carbon monoxide

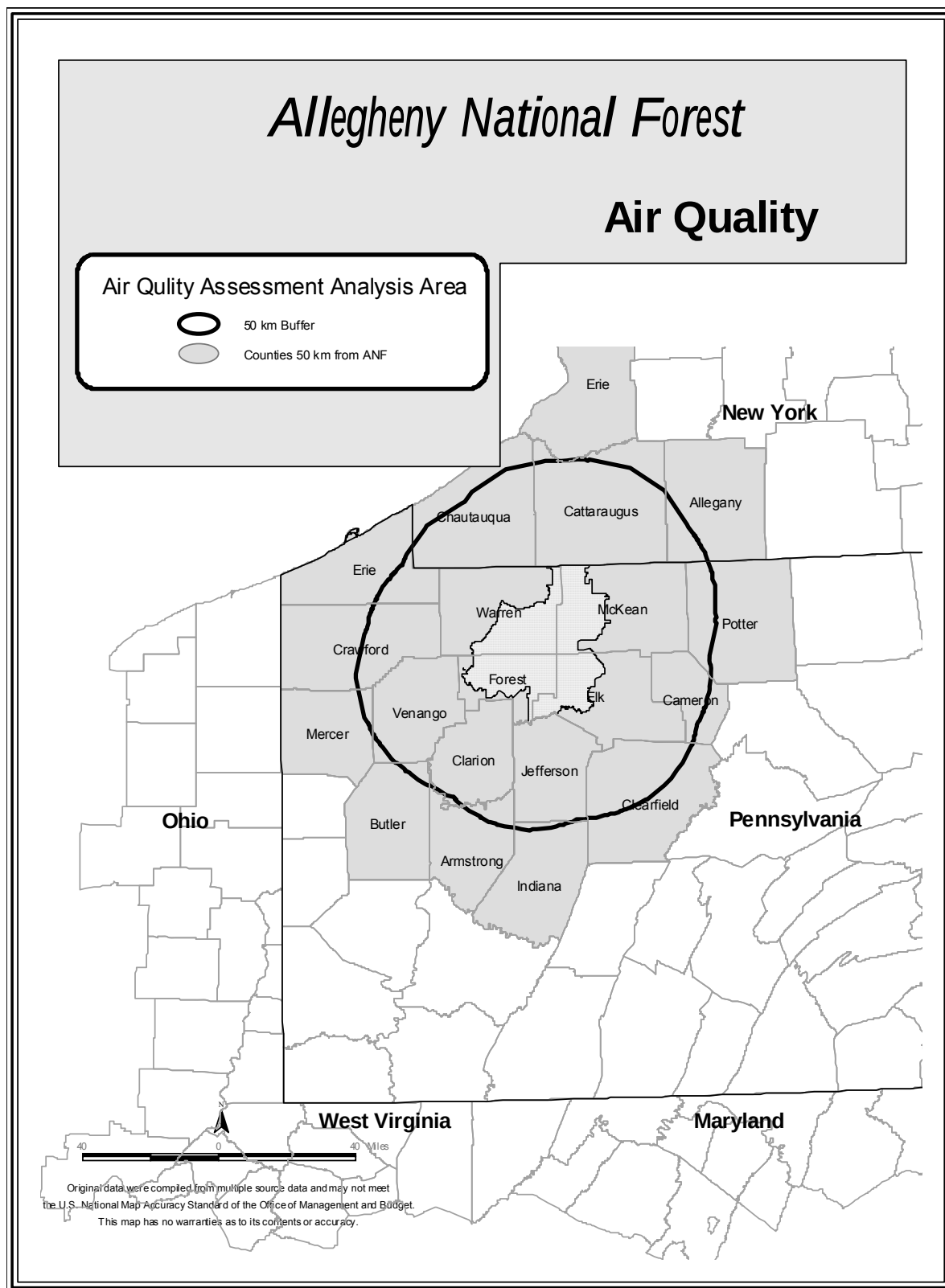
Carbon monoxide (CO) is a common air pollutant of which 77 percent is emitted by transportation sources, including highway and recreational motors. Other sources of CO include industrial processes and forest fires. CO can cause serious human health effects. CO is the product produced when fuels do not burn completely. The highest levels of CO commonly occur during thermal inversions in the coldest months of the year. There are two NAAQS standards for CO: a 1-hour standard of 35 ppm and an 8-hour standard of 9 ppm, both not to be exceeded more than once per year.

Direct and indirect effects

Scope of analysis

Analyses for direct and indirect effects of air pollution are limited to pollution emitted from within lands administered by the ANF as a result of management activities. However, because air pollution disperses beyond political boundaries, levels of pollution emitted from ANF management activities must be evaluated taking into consideration regional pollution loads and current air quality monitoring data. Pollution coming from ANF management activities can affect air quality within ANF boundaries as well as outside. Likewise, pollution from sources outside the ANF boundary affects ANF resources as well as regional air quality. For this reason, air pollution must be evaluated in both a regional and cumulative context, and it is imperative that an area larger than just NFS lands is used in an air quality evaluation. An analysis area with a radius of 31.07 miles (50 kilometers) from the ANF boundary will be used to describe the effects of emissions from the ANF on regional air quality in this document. This distance was determined to be adequate to describe the area potentially affected by the mobile and area sources of pollution from ANF management activities. Figure 3-2 shows the analysis area. The cumulative effects analysis will primarily be bound by the timeframe from the adoption of the 1986 Forest Plan until the assumed date of the next revision of the forest plan, 2020.

Figure 3-2. Air quality cumulative effects analysis area



Introduction to effects

Although a majority of this area's pollution comes from sources outside the National Forest, activities from within the ANF boundaries can also affect air quality in the region. Activities such as timber harvesting, oil and gas well drilling and operations, road construction, road maintenance, road use, off-highway vehicle use and prescribed fire all produce emissions. Additionally, effects of these activities may exacerbate existing air quality related issues (see soil resource section). However, not all of these activities are expected to change much by alternative within the timeframe of this analysis. The number of days where FS road construction or maintenance occurs is not expected to increase over existing levels or change much by alternative. Road use from visitors and administrative activities is not expected to vary much by alternative. Private oil and gas development and operations will be included in cumulative effects. The remaining activities, timber harvesting, ATV/OHM use, and prescribed fire, are expected to change by alternative.

Though both volatile organic compounds (VOCs) and nitrogen oxides contribute to ozone formation, nitrogen oxide is the limiting factor in ozone production. Therefore nitrogen oxide emissions will be assessed in this analysis along with particulate matter. Particulate matter (PM) and nitrogen oxide emissions from these activities will contribute to the total pollution load and are the major pollutants of concern in terms of contributions to NAAQS. Therefore, potential emissions of these pollutants will serve as indicators for air quality effects. Potential emissions of PM and nitrogen oxide from predicted timber harvest, ATV/OHM use, and prescribed fire activities will be evaluated in comparison to total PM and nitrogen oxide emissions in counties near the ANF.

Current air pollution impacts occurring on the ANF are the cumulative result of numerous sources. Pollution from sources such as automobiles, off-road construction equipment, wildland fires, factories, oil refineries, and power plants all contribute to the regional pollution load. The ANF is situated near the industrial heart of the United States. It is within a day's drive of a large percentage of the United States' population, and is downwind of a high concentration of coal-fired electric generating facilities; the leading source of sulfur dioxide (SO₂) and nitrogen oxide (NO_x) emissions. This network of coal-fired power plants includes the generally defined "Ohio River Valley." In the 20 counties in New York and Pennsylvania within 50 kilometers of the ANF there are 10 existing major coal-fired power plants (US EPA 2003).

While sources of PM outside of the ANF have a major affect on air quality, FS activities can affect air quality. Smoke emitted from forest fires, both prescribed and wild, is a major concern in terms of ANF activities that have the potential to affect air quality. Soot particles from wildland fires are a small, but significant part of the total PM_{2.5} load. The LRMP prescribes smoke management standards and guidelines that will minimize the impacts of smoke from prescribed burning on smoke-sensitive sites. It is also important to note that production of thermal nitrogen oxide increases with increasing burn temperature. Relatively low-temperature prescribed fires emit very little nitrogen oxide as compared to wildfires where burn temperature is not controlled. Prescribed fire situations provide land managers with the opportunity to minimize the impacts of smoke on local communities, while a wildfire situation does not typically afford such an opportunity.

Of the counties within 50 kilometers of the ANF, eight counties (Erie, Mercer, Butler, Armstrong, Indiana, and Clearfield, PA, and Chautauqua and Erie NY) are in non-attainment status for 8-hour ozone and three counties or parts of counties (Butler, Armstrong, and Indiana) are in non-attainment status for particulate matter less than 2.5 microns (US EPA 2005). There were no other areas in non-attainment for any other criteria pollutants (carbon

monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter less than 10 microns) listed in the US EPA Green Book. The eight counties in non-attainment are on the edge of the counties within 50 kilometers of the ANF, except for Chautauqua County NY, so are therefore less likely to affect or be affected by air quality on the National Forest.

Pollution monitoring data from two stations in the National Atmospheric Deposition Program near the ANF (Kane Experimental Forest in Pennsylvania and Chautauqua County in New York) correlate with national trends in pollution. Sulfate deposition has decreased rapidly at both stations while ammonium and nitrate have also decreased over time, but at a slower rate. Precipitation pH has increased indicating that acidity has decreased. Calcium and magnesium levels have also decreased as they also are emitted as a pollutant from power plants that have seen increasing regulations to curb air pollutant emissions. The benefits to soil and stream pH of reducing acidic air pollutants such as sulfate and nitrate are somewhat reduced by the subsequent reduction in base cations.

Effects common to all alternatives

Administrative vehicle use and visitor vehicle use will produce emissions of primarily volatile organic compounds and nitrogen oxides. However, administrative and visitor vehicle use will not likely vary by alternative.

Snowmobile use will produce emissions of volatile organic compounds, particulate matter, nitrogen oxides, and carbon monoxides. However, snowmobile usage is not expected to change between alternatives.

Both herbicides proposed for use in all alternatives, glyphosate and sulfometuron methyl, have a low volatility, are being applied from the ground, and are being applied in relatively small amounts. Therefore effects on air quality will be minor, short-term, and localized. Likewise, neither herbicide is expected to add a significant contribution to acid rain. Even in an extreme case where a maximum dose of herbicide entered the air, the impacts will be minor and localized.

Effects from each alternative

Prescribed burning emissions

Emissions estimates per acre burned in each alternative were derived using the First Order Fire Effects Model (FOFEM, Version 5.0, Rocky Mountain Research Station). This emissions estimate was then multiplied by the potential acreage that will be burned each year in each alternative to get an annual emissions estimate to compare to regional (all counties within 50 kilometers of the ANF) annual emissions. It is important to note that the number of acres treated with prescribed fire annually is highly dependent on weather and climatic conditions among other local factors. Because there is no way to predict where and when individual prescribed burns will occur, this analysis broadly assumes that the same number of acres will be treated with prescribed fire annually at the maximum level for each alternative. In reality, there will likely be some years with little prescribed fire activity, while others may be much closer to the maximum annual estimate.

The regional emissions data were obtained from the most recent and accurate emissions database available. Currently, this is the 2002 VISTAS base case emissions database. It can be assumed that if

predicted emissions from the proposed prescribed fire activities contribute a small enough percentage to the total pollution load, they will not impact attainment of the NAAQS. Most counties within 50 kilometers of the ANF are either in attainment or unclassifiable status (three counties are in non-attainment for particulate matter 2.5 and eight counties are in non-attainment for 8-hour ozone out of a total of 20 counties in the region). A percentage threshold of 5 percent has been chosen for the emissions comparison. The threshold of 5 percent was chosen to be very conservative in protecting air quality. Air regulations often include a 5 percent change as a significance threshold for more rigorous or refined air quality analyses. If emissions from prescribed fire activities do not exceed 5 percent of the total pollution load in the region, they will be considered below our level of concern.

Because site-specific burn units have not been identified within the scope of this assessment, fuel loading characteristics are unknown at this time. For this reason average fuel loading characteristics that were calculated from forest inventory data were used in the emissions analysis. For fuel moisture levels a range representative of fuel moisture under which prescribed burning will be conducted were used in the model to vary emissions. The range of potential emissions from the fuel loading characteristics and their effects on air quality are presented in Table 3-11.

Table 3-11. Estimated future average annual air pollutant emissions from prescribed burning on the ANF

Alternative	Pollutant	Rx Fire Emissions (Tons per Year)		Total Regional Emissions (Tons per Year)	Percent Rx Fire of Total Regional Emissions	
		Decade			Decade	
		1	2		1	2
Alternative A	PM10	85 to 89	85 to 89	63,380	0.13 to 0.14	0.13 to 0.14
	PM2.5	72 to 76	72 to 76	27,770	0.26 to 0.27	0.26 to 0.27
	NOx	2 to 2	2 to 2	223,110	0.00 to 0.00	0.00 to 0.00
	CO	945 to 991	945 to 991	1,157,352	0.08 to 0.09	0.08 to 0.09
Alternative B	PM10	158 to 166	162 to 170	63,380	0.25 to 0.26	0.26 to 0.27
	PM2.5	134 to 140	137 to 144	27,770	0.48 to 0.50	0.49 to 0.52
	NOx	4 to 5	4 to 5	223,110	0.00 to 0.00	0.00 to 0.00
	CO	1744 to 1828	1788 to 1875	1,157,352	0.15 to 0.16	0.15 to 0.16
Alternative Cm	PM10	160 to 167	157 to 165	63,380	0.25 to 0.26	0.25 to 0.26
	PM2.5	135 to 142	133 to 140	27,770	0.49 to 0.51	0.48 to 0.50
	NOx	4 to 5	4 to 5	223,110	0.00 to 0.00	0.00 to 0.00
	CO	1763 to 1849	1739 to 1823	1,157,352	0.15 to 0.16	0.15 to 0.16
Alternative D	PM10	94 to 98	94 to 98	63,380	0.15 to 0.15	0.15 to 0.15
	PM2.5	79 to 83	79 to 83	27,770	0.29 to 0.30	0.29 to 0.30
	NOx	2 to 3	2 to 3	223,110	0.00 to 0.00	0.00 to 0.00
	CO	1036 to 1086	1036 to 1086	1,157,352	0.09 to 0.09	0.09 to 0.09

Emission estimates per acre burned were derived from the FOFEM model. The number of acres potentially burned for fuels, wildlife, and silvicultural management purposes vary by alternative, and thus the prescribed fire annual emissions also varies (Table 3-11). Alternative B will propose the most area to receive prescribed burning per year. Slightly less prescribed burning is proposed in Alternative Cm and even less in Alternative D. Under Alternative A, prescribed fire usage will be the least of all alternatives at approximately 275 acres per year (Table 2-2).

Annual emission estimates from prescribed fire activity in all alternatives are well below the regional pollution contribution threshold of 5 percent and therefore are not a major concern. This however does not preclude the ANF from using the best available smoke management techniques and technology to alleviate nuisance or human health impacts of smoke in local communities and smoke sensitive areas, or from avoiding impacting attainment status for any criteria pollutant in areas where burns are conducted.

Vegetation management emissions

Rough emissions estimates were made using some basic assumptions that have been developed for typical timber harvests in mountainous areas, such as the types of equipment that are likely to be used, the number of hours a day this equipment will be operating, and how many days out of the year this will occur based on the total volume of timber removed. Using these assumptions, an estimate of the hours of operation for each piece of equipment was derived and this was multiplied by an emissions factor (in pounds per hour) for each type of equipment.

Emission factors used were developed by the US EPA (US EPA 2004, p.4-5; 2004a, p.5-8, 1997). These emissions were then converted to tons per year for comparison to regional emissions. Because the exact timing of harvesting activities can not be predicted within the scope of this assessment, the estimates are based on the total volume removed in each alternative by decade, which was apportioned equally over the ten-year period for which harvest activities are expected to occur.

As in the prescribed fire analysis, emissions from timber harvest activities were interpreted in the context of the regional pollution load. The estimated annual emissions were compared to total annual emissions from all counties within approximately 30 miles of the ANF. Again, the emissions data for the analysis area were obtained from the 2002 VISTAS base case emissions database, and the 5 percent of total region emissions threshold was used for the comparison. The annual emission estimates from timber harvest activities in all alternatives are well below the regional pollution contribution threshold of 5 percent (Table 3-12). The relative contribution to regional pollution was greatest in Alternatives A and B and least in Alternative D with Alternative Cm contributing intermediate amounts of modeled emissions from timber harvest.

Table 3-12. Estimated future average annual air pollutant emissions from timber harvest on the ANF

Alternative	Pollutant	Timber Harvest Emissions (Tons per Year)		Total Regional Emissions (Tons per Year)	Percent Timber Harvest of Total Regional Emissions	
		Decade			Decade	
		1	2		1	2
Alternative A	VOC	230 to 230	230 to 230	63,380	0.36 to 0.36	0.36 to 0.36
	PM	11 to 11	11 to 11	27,770	0.04 to 0.04	0.04 to 0.04
	NOx	219 to 219	219 to 219	223,110	0.10 to 0.10	0.10 to 0.10
	CO	1176 to 1176	1176 to 1176	1,157,352	0.10 to 0.10	0.10 to 0.10
Alternative B	VOC	217 to 217	217 to 217	63,380	0.34 to 0.34	0.34 to 0.34
	PM	10 to 10	10 to 10	27,770	0.04 to 0.04	0.04 to 0.04
	NOx	207 to 207	207 to 207	223,110	0.09 to 0.09	0.09 to 0.09
	CO	1101 to 1101	1101 to 1101	1,157,352	0.10 to 0.10	0.10 to 0.10
Alternative Cm	VOC	188 to 188	188 to 188	63,380	0.30 to 0.30	0.30 to 0.30
	PM	9 to 9	9 to 9	27,770	0.03 to 0.03	0.03 to 0.03
	NOx	179 to 179	179 to 179	223,110	0.08 to 0.08	0.08 to 0.08
	CO	951 to 951	951 to 951	1,157,352	0.08 to 0.08	0.08 to 0.08
Alternative D	VOC	91 to 91	91 to 91	63,380	0.14 to 0.14	0.14 to 0.14
	PM	4 to 4	4 to 4	27,770	0.02 to 0.02	0.02 to 0.02
	NOx	87 to 87	87 to 87	223,110	0.04 to 0.04	0.04 to 0.04
	CO	460 to 460	460 to 460	1,157,352	0.04 to 0.04	0.04 to 0.04

All terrain vehicle and off highway motorcycle emissions

All-terrain vehicles (ATVs) and off highway motorcycles in the United States currently emit annually about 130,000 tons of hydrocarbons (VOC), 550,000 tons of carbon monoxide (CO), and 4,000 tons of oxides of nitrogen (NOx) (US EPA 2002, p.1). ATV and off highway motorcycle emissions were calculated using US EPA emission factors and estimated hours riders spend on forest. Three assumptions were used in the analysis: the ratio of four-stroke to two-stroke engines is 4:1, 80 percent of time spent on forest is actively riding, and the average riding speed is twenty-five miles per hour. US EPA has just implemented new emissions regulations for ATVs starting with models built in 2006. These new US EPA emissions regulations were not considered due to the lag time for full implementation. However, due to these regulations the total ATV emissions should decrease due to the higher standards. The predicted emissions from motorized trail use are shown in Table 3-13. The ATV and OHM emissions are well below the 5 percent threshold in all alternatives so it appears that they will not appreciably contribute to regional air pollution.

Table 3-13. Estimated future average annual air pollutant emissions from all terrain vehicles and off highway motorcycles on the ANF

Alternative	Pollutant	ATV Emissions (Tons per Year)		Total Regional Emissions (Tons per Year)	Percent ATV of Total Regional Emissions	
		Decade			Decade	
		1	2		1	2
Alternative A	VOC	80 to 105	43 to 110	63,380	0.13 to 0.17	0.07 to 0.17
	PM	3 to 4	2 to 4	27,770	1.01 to 0.01	0.01 to 0.02
	NOx	2 to 3	1 to 3	223,110	0.00 to 0.00	0.00 to 0.00
	CO	76 to 100	41 to 105	1,157,352	0.01 to 0.01	0.00 to 0.01
Alternative B	VOC	82 to 108	44 to 113	63,380	0.13 to 0.17	0.07 to 0.18
	PM	3 to 4	2 to 4	27,770	0.01 to 0.02	0.01 to 0.02
	NOx	2 to 3	1 to 3	223,110	0.00 to 0.00	0.00 to 0.00
	CO	78 to 103	42 to 108	1,157,352	0.01 to 0.01	0.00 to 0.01
Alternative Cm	VOC	79 to 104	43 to 109	63,380	0.13 to 0.16	0.07 to 0.17
	PM	3 to 4	2 to 4	27,770	0.01 to 0.01	0.01 to 0.02
	NOx	2 to 3	1 to 3	223,110	0.00 to 0.00	0.00 to 0.00
	CO	76 to 99	41 to 104	1,157,352	0.01 to 0.01	0.00 to 0.01
Alternative D	VOC	57 to 76	31 to 79	63,380	0.09 to 0.12	0.05 to 0.13
	PM	2 to 3	1 to 3	27,770	0.01 to 0.01	0.01 to 0.01
	NOx	2 to 2	1 to 2	223,110	0.00 to 0.00	0.00 to 0.00
	CO	55 to 72	29 to 76	1,157,352	0.00 to 0.01	0.00 to 0.01

Cumulative effects

Pollution monitoring data from 2 stations in the National Atmospheric Deposition Program near the ANF (Kane Experimental Forest in Pennsylvania and Chautauqua County in New York) correlate with national trends in pollution. Sulfate deposition has decreased at a steady rate at both stations while ammonium and nitrate have remained fairly constant. Precipitation pH has increased indicating that acidity has decreased. These trends have been primarily happening since the Clean Air Act amendments of 1990.

Emissions from the three main sources of air pollution expected on the ANF were summed and again compared to regional emissions and again all alternatives are well below the 5 percent threshold so are assumed to not be appreciably contributing to regional air pollution. Additional emissions in and around the ANF include visitor vehicle use and administrative vehicle use by the FS both of which are not expected to vary by alternative. Also vehicles and equipment used in oil and gas extraction and development will add to regional pollutant emissions, but the level and amount of contribution is considered small and would be difficult to estimate. There are also

many various small emissions source on private land within the proclamation boundary and in the area around the ANF (e.g. timber harvest on private land, home and business heating, lumber mills). These many small emissions sources and the fewer larger sources of air pollution (e.g. 10 major coal-fires power plants, oil refineries) in the counties within 50 kilometers of the ANF contribute to the regional air quality of the ANF. Table 3-14 shows the 2002 emissions within that region and the relative contribution from activities on the ANF that vary by alternative (the high estimates of prescribed burning, timber harvest and motorized trail use) have on those emission levels.

The four counties in which the ANF is located are currently in attainment of all NAAQS and the contributions of the alternatives do not appear to raise the emissions levels appreciably (usually less than 5%). The contributions from the ANF are all below 5 percent for both the regional and the four counties areas and are therefore considered to not appreciably contribute to air pollution in the region.

Table 3-14. Estimated future average annual air pollutant emissions from prescribed burning, timber harvest, all terrain vehicles and off highway motorcycles on the ANF

Including comparison against regional and four-county pollutant data.

	Pollutant	ANF Management Emissions (Tons per Year)		Total Regional Emissions (Tons per Year)	Percent ANF Management of Total Regional Emissions		4 county emissions (Tons per Year)	Percent ANF Management of 4 county Emissions	
		Decade			Decade			Decade	
		1	2		1	2		1	2
Alt. A	VOC	337	342	63,380	0.53	0.54	12,047	2.80	2.84
	PM	91	91	27,770	0.33	0.33	5,322	1.72	1.72
	NO _x	226	227	223,110	0.10	0.10	11,188	2.02	2.02
	CO	2267	2272	1,157,352	0.20	0.20	66,765	3.40	3.40
Alt. B	VOC	325	330	63,380	0.51	0.52	12,047	2.70	2.74
	PM	155	159	27,770	0.56	0.57	5,322	2.91	2.99
	NO _x	215	215	223,110	0.10	0.10	11,188	1.92	1.92
	CO	3032	3084	1,157,352	0.26	0.27	66,765	4.54	4.62
Alt. Cm	VOC	292	297	63,380	0.46	0.47	12,047	2.42	2.47
	PM	155	153	27,770	0.56	0.57	5,322	2.91	2.88
	NO _x	187	187	223,110	0.08	0.08	11,188	1.67	1.67
	CO	2900	2878	1,157,352	0.25	0.25	66,765	4.34	4.31
Alt. D	VOC	166	170	63,380	0.26	0.27	12,047	1.38	1.41
	PM	90	90	27,770	0.33	0.33	5,322	1.70	1.70
	NO _x	91	91	223,110	0.04	0.04	11,188	0.82	0.82
	CO	1618	1621	1,157,352	0.14	0.14	66,765	2.42	2.43

3.2.5 Transportation Resources

This section has been updated to be consistent with modifications to Alternative C, and to add a brief discussion of the new travel management rule.

Travel is associated with virtually every activity that takes place on the ANF. Travel is necessary for outdoor recreation, fighting wildfires, managing wildlife, removing marketable natural resources such as timber, oil, and gas, gathering fuelwood, access to private inholdings, maintaining electronic sites and utility corridors, and managing and monitoring the forest.

Travel management is a tool used to facilitate the movement of people and products. It provides opportunities for the activities listed above and protects resources, mitigates impacts, and minimizes conflicts. Each time a travel management decision is implemented, some users will benefit and others may not. For example, when an area or road is restricted from motorized travel to protect wildlife, there may be a secondary effect on people. A closure prohibits motorized travel and protects the wildlife, but it also restricts access for persons with disabilities requiring vehicles for access, may limit firewood gathering, and may reduce opportunities for some forms of recreation. Conversely, it could likely give hikers, horseback riders, and those viewing wildlife or seeking solitude a more peaceful undisturbed experience.

On November 9th, 2005, changes to 36 CFR parts 212, 251, 261 and 295 were published in the Federal Register. These changes are referred to as the Travel Management Rule.

The new Travel Management Rule is a fundamental change in how the FS designates where and how motor vehicles can operate on National Forest System Lands. The Travel Management Rule was developed to provide:

1. A consistent national approach and terminology for travel management.
2. A framework to manage motor vehicle use.
3. Reduce the number of unplanned, unmanaged user created routes.

The Travel Management Rule requires:

1. Designation of roads, trails, and areas open to motor vehicle use by vehicle class and, if appropriate, by time of year.
2. Public involvement and coordination with state and local agencies.
3. Prohibition of use inconsistent with the designations or off the designated system following the publication of the motor vehicle use map.

As a result of the Travel Management Rule, some forests will be making significant changes in the way motor vehicle use is managed on the ground. For the ANF, the most significant change will be in the requirement to publish a motorized vehicle use map annually. The ANF is scheduled to publish their first map on July 8, 2008.

Modes of vehicle travel on the ANF include large commercial trucks, automobiles, pickups, four-wheel drive vehicles, snowmobiles, ATVs, motorcycles, mountain bikes, and wheelchairs. Other travel modes include cross-country skiing, horseback riding, and hiking. These various forms of travel may occur on designated paved highways, gravel and dirt roads, unimproved roads, and trails designated for motorized and/or non-motorized use. Motorized travel is allowed only on designated roads and trails on the forest. Of particular interest in travel management is the emergence of mountain bikes, and increased ATV, OHM, and snowmobile use since the 1986 Forest Plan.

As use of the ANF increases, travel management will be increasingly important as a tool for mitigating impacts on the various resources and for coordinating uses. The ANF needs to work closely with all user groups to maintain travel and recreation opportunities and identify routes where these activities can continue. Public information and education regarding travel management and the need for restrictions must be emphasized. A balance between motorized and non-motorized recreation opportunities needs to be achieved and is likely to require compromises by each user group to mitigate conflicting demands. Motorized and non-motorized trails are discussed in the recreation section of this document.

Primary access into and out of the ANF for recreation, administration, private rights, and commodity production is provided by state highways. There are 677 miles of state highways and township roads within the proclamation boundary (Table 3-15). The ANF is a common destination for recreationists from major cities such as Buffalo, NY; Erie, PA; Cleveland, OH; Columbus, OH; and Pittsburgh, PA. There are many smaller cities within about 50 miles of the ANF such as Corry, Meadville, Oil City, Franklin, Clarion, Dubois, and Clearfield, all in PA, and Jamestown and Olean in NY. Primary access to the ANF area occurs from the:

- Southwest by way of I-80, then either US 62 through Oil City or SR 66 through Clarion
- South by way of SR 66 through Clarion
- Southeast by way of I-80, then US 219 through Ridgway
- East by way of US 6 through Kane
- Northeast by way of US 59 through Smethport or I-86 then US 219 through Bradford
- North by way of I-86 then US 62 through Warren
- Northwest by way of US 6 through Warren
- West by way of US 27 through Youngsville or US 36 through Tionesta

Reasonable access to private inholdings has to be considered in travel management. In addition, existing and future rights-of-way and easements will continue to ensure that public access to FS lands is maintained. As lands adjoining the ANF have shown a change in use patterns over time, previous access by the public across these private lands is also changing. Without public access, the portion of the roads on the ANF can lose their value and

could be recommended for closure. Where public access is not available, roads on the ANF may be closed, motorized use eliminated, or a special use permit will be required for motorized access. This may restrict motorized access to portions of the ANF from some private lands.

Affected environment

The FS describes the road system by several different methods. Three are relevant to the effects analysis for the LRMP, and are described below: maintenance of the FS road system, road surfacing, and road management.

Maintenance of the FS road system

A road maintenance level (ML) defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria (FSH 7709.58, Sec 12.3, Transportation System Maintenance Handbook). Road construction, maintenance, and decommissioning, addressed under effects, are linked to maintenance level classification.

Maintenance Level 1

The ML1 classification is assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are “prohibit” and “eliminate.” Roads receiving ML1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at ML1, they are closed to vehicular traffic, but may be open and suitable for non-motorized uses.



Figure 3-3. Maintenance Level 1 Road

Maintenance Level 2

The ML2 classification is assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either discourage or prohibit passenger cars, or accept or discourage high clearance vehicles.



Figure 3-4. Maintenance Level 2 Road

Maintenance Level 3

The ML3 classification is assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either “encourage” or “accept.” “Discourage” or “prohibit” strategies may be employed for certain classes of vehicles or users.



Figure 3-5. Maintenance Level 3 Road

Maintenance Level 4

The ML4 classification is assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is “encourage.” However, the “prohibit” strategy may apply to specific classes of vehicles or users at certain times.



Figure 3-6. Maintenance Level 4 Road

Maintenance Level 5

The ML5 classification is assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is “encourage.”



Figure 3-7. Maintenance Level 5 Road

The ANF is unique in that there is a system of OGM roads in addition to the state, township and FS roads. There are an estimated 1,200 miles of OGM roads on the ANF. This number is our best estimate as of March 15, 2003. The OGM roads are not open for public use; however, many OGM operators do not gate their roads. Although FS roads are usually marked at the entrance with a road number, it is often difficult for the public to determine the difference between a FS road and an OGM road. Table 3-15 shows miles of FS, state/township, and private roads, and motorized and non-motorized trails on FS lands and within the proclamation boundary.

Table 3-15. Total road and trail miles within the ANF proclamation boundary, 2003

Ownership	Miles within Proclamation Boundary	Miles On NFS Administered Land
FS Maintenance Level 1 and 2	677	670
FS Maintenance Level 3, 4, and 5	590	561
State/Township	677	281
Private and Other Agencies	2,527	1,236
Total – Road only	4,471	2,748
Forest Trails (motorized and non-motorized- includes trails on roads)	672	635
Forest Trails (motorized and non-motorized – trails not on roads)	354	354

Road surfacing (pit run/limestone/pavement)

Choice of road surfacing material contributes to effects of roads on other resources, such as soil and water quality. Generally, the harder the running surface, the less likely it is to erode. Most FS system roads (91%) are surfaced with “pit run” material, local sandstone that fractures easily, and breaks down rapidly from exposure to the environment, and from the weight of vehicle traffic. These roads are resurfaced approximately every 12 years.

Pit run is excavated by developing a ‘borrow pit’. Surface topsoil is first removed and stockpiled, and the pit run is then removed by excavator, front-end loader, or similar mechanized equipment. There are 335 active and 216 closed borrow pits, of which 33 have been rehabilitated on the ANF. There are an estimated 1,100 acres of land occupied by borrow pits.

There are two main concerns with pit run material. First, pit run tends to break down quickly into fine particles that are subject to creating dust during dry weather and sediment during wet weather and spring run-off. Second, there is concern that the quality, quantity, and access to pit run material is decreasing. Alternative road surfacing materials are being investigated for use.

Limestone is preferred to sandstone as a road surfacing material because it is more resistant to physical breakdown, and therefore reduces erosion and potential sedimentation. In 1997, the 1986 Forest Plan was amended to address road-related concerns (among others) in riparian areas. Design criteria were summarized that address guidelines for road design in proximity to streams. Since 1997, 72 miles of limestone surfacing has been applied, generally on road segments that are within 300 feet of a stream and at stream crossings. Limestone is not found locally, and is therefore a more costly alternative to pit run material. While the use of limestone may be limited due to economic constraints, expanded consideration for its use outside of streamside zones has been made on public FS roads.

Paved road surfaces result in the least erosion due to running surface; however, there are other kinds of pollutants such as thermal or chemical pollution that could occur. Paved roads are extremely expensive and generally are not economically feasible in most forest settings.

Road management

Connected to state highways and township roads are a system of FS administered roads. There are 677 miles of FS ML 1 and 2 roads and 590 miles of ML 3, 4, 5 roads within the ANF proclamation boundary (Table 3-15) (USDA FS 2003b Appendix A – Map 2). Forest Service roads are managed for public traffic. Guidance for determining how specific roads should be managed is found in the 1986 Forest Plan, and varies by management area. General management area direction and road guidelines information is summarized in the LRMP. Road allocation by management area is shown in Appendix B, Table B-42. Forest Service road management on the ANF can be divided into three broad categories. Open roads are typically open for public traffic; closed roads are typically closed for public traffic; and restricted roads may be open or closed to public traffic or types of public traffic depending on the time of year and resource needs.

Currently, when considering all ML 1-5 State, township, private, other agency, and FS Roads, 9 percent are restricted, 25 percent are open, and 66 percent are closed (USDA FS 2003b Appendix A, map 3). Of all FS Roads (ML 1-5), 30 percent are restricted, 36 percent are open, and 34 percent are closed.

In the Spring of 2003, the ANF completed a Forest Wide Roads Analysis Plan (FWRAP, USDA FS 2003b). It is not a decision document but it provides valuable information for managing the road system on the ANF, providing “critical information needed to identify and manage a minimum road system that is safe and responsive to public needs and desires, is affordable and efficient, has minimal adverse effects on ecological processes and ecosystem health, diversity, and productivity of the land, and is in balance with available funding for needed management actions” (FSM 7712.1). The primary focus of the ANF FWRAP is the portion of the road system maintained for passenger car use (ML 3, 4 and 5 roads). The analysis does not cover roads maintained for high-clearance vehicles (ML 2 roads), closed roads (ML 1 roads) or unclassified roads (user-created). Roads analysis at the site-specific and watershed level will address these roads.

The FWRAP also includes a discussion on road density. On FS-administered lands, there are 1.9 miles of improved highways (state, township, and FS) per square mile and 1.5 miles per square mile of unpaved dirt and gravel roads. Within the proclamation boundary, using the same roads, there are 1.7 miles of improved highway per square mile and 2.2 miles of unpaved and dirt roads per square mile. These road densities are well within the standards and guidelines provided in the 1986 Forest Plan. Refer to the FWRAP for more information on road conditions, issues, benefits and risks, and opportunities on the ANF.

Direct and indirect effects

The following measures were used for the effects analysis and are found in the sections below:

- Maintenance of the FS road system
- Miles of road construction (new and existing corridor)
- Miles of road reconstruction
- Miles of road decommissioning
- Miles of FS system roads
- Road surfacing

- Additional acreage for gravel pits
- Total FS road system

Table 2-2 provides estimates for each activity by alternative. Activity descriptions follow Table 2-2.

Scope of the analysis

The analysis area for direct and indirect effects includes all federal land managed by the ANF. The analysis area for cumulative effects includes all the area within the proclamation boundary. This includes both ANF-administered lands and transportation systems, and the adjacent lands administered by other owners, both public and private, with transportation systems that link to, or are directly affected by, actions taken on ANF-administered lands.

Effects common to all alternatives

In all alternatives, protection of soil, aquatic, and riparian systems will be given more attention in future road operations. Current inadequate stream crossings will either be rebuilt or removed. Bridges and open bottom arches will be preferred over round culverts to improve aquatic conditions. As the need for repair or replacement of existing structures arises, design will provide for added streambed and bank stability as well as for fish migration. Reconstruction of roads will include moving the travelways away from streams where feasible and reducing the size of the connected disturbed area.

Under all alternatives, coordination and collaboration with other federal, state, and township officials in the management of transportation facilities to and through the ANF will be continued. This is to ensure that access is maintained, standards are consistent, safety issues are addressed, and efficiency is considered at all times.

Effects of the alternatives

Maintenance of the FS road system

Road construction, maintenance, and decommissioning under each alternative are designed to provide full access to all necessary management areas for full implementation of each alternative. Road design under all alternatives considers results of the FWRAP, and other previous road planning efforts from the mid-1980s to today, including integrated resource management opportunity analyses and project-level roads analyses.

This section includes activities relating to developing and maintaining the FS road system. Future access planning was accomplished using GIS. Based on the management area direction and the proposed management area allocation, a complete road system was developed for each alternative that would provide full access for proposed management activities (e.g. timber sale access) by the end of the sixth decade. New additions anticipated by the midpoint of the second decade (2020) are based on harvest scheduling in each alternative.

The following criteria were used in developing this potential road system:

- Minimize the number of perennial and intermittent stream crossings
- Minimize the length of road crossing on poorly drained soils

- Utilize existing corridors as much as possible (existing OGM roads and other travelways)
- Minimize the use of ROWs
- Minimize crossing management areas that exclude roads to access management areas that require additional access

Note that these potential roads have not been field verified. There are many streams that do not show on the GIS layer for streams, there are many inclusions on poorly drained soils within well drained and moderately drained soils. A site-specific NEPA analysis will need to be completed prior to construction of any of these potential roads that may change the location and the length. Table 3-16 indicates the system of roads necessary to provide access in this planning period (2020) and for full system completion in 2060. The 2020 estimate used the following criteria when adding new roads (construction) to the system:

- All the existing roads and half of the new corridors in MAs 1.0, 2.1, 3.0, 6.2 will be added to the system by 2020
- 10 percent of the existing roads and 10 percent of the new corridors in MA 6.1 will be added to the system by 2020
- 25 percent of the existing roads in MA 2.2 will be added to the system by 2020
- Half of the existing roads and half of the new corridors on private will be added to the system by 2020

Table 3-16. Projected road system by alternative*

	Management Area	Second decade	Sixth decade
Alternative A	Current FS roads that remain (miles)	1269	1269
	New construction in existing corridor (miles)	191	271
	New construction in new corridor (miles)	116	344
	Total FS Roads (miles)	1576	1884
Alternative B	Current FS roads that remain (miles)	1269	1269
	New construction in existing corridor (miles)	203	269
	New construction in new corridor (miles)	103	214
	Total FS Roads (miles)	1574	1751
Alternative Cm	Current FS roads that remain (miles)	1261	1255
	New construction in existing corridor (miles)	192	265
	New construction in new corridor (miles)	85	178
	Total FS Roads (miles)	1538	1703
Alternative D	Current FS roads that remain (miles)	1226	1226
	New construction in existing corridor (miles)	171	258
	New construction in new corridor (miles)	69	152
	Total FS Roads (miles)	1466	1636

* This table does not include decommissioning beyond that needed to meet management area direction.

Road construction, in both existing and new corridors, occurs in all alternatives to provide access to all areas of the ANF scheduled for management activities. Alternatives A and B provide equal amounts of new road construction. Alternative Cm is 90 percent and Alternative D is 78 percent of the levels in Alternative A (see Table 2-2).

Condition, location, level of use, and maintenance of roads are more important than number of roads (road density) in terms of water quality. Effects of soil erosion, compaction, puddling, and rutting relating to road construction and maintenance are described in the soil resources section. Effects of roads on water quality and streamflow are discussed in the water resources section. Effects of road construction and management on wildlife are discussed in the wildlife section (e.g. Table 3-54, Table 3-60, Table 3-67). Effects of roads and trails on recreation opportunities are discussed in the recreation opportunities section.

Maintaining or decommissioning existing roads and trails occur in all the alternatives. All alternatives include 100 miles/year for road reconstruction. This is the level of maintenance needed to resurface approximately 8 percent of FS system roads per year (for a 12-year rotation of the entire system). Nationally, the trend is to direct maintenance funding to decommissioning unneeded roads and improving the maintenance condition of those remaining. Road maintenance and resurfacing will have an overall beneficial effect by reducing sediment runoff in streams.

Methods of decommissioning include, but are not limited to, signing and physical closures such as earth berms, boulders, scattering downed vegetation, scarifying, seeding, recontouring, and removal of structures such as culverts. The goal is to return the roadway to a more natural state where the roadway is hydrologically self-maintaining and to permanently remove it from the transportation system. Roads could also be converted to motorized or non-motorized trails.

Alternative D has the highest level of decommissioning; Alternatives A, B, and Cm are roughly equal with regards to decommissioning.

Surfacing Material and Gravel Pits

Based upon this road system, estimates were made for pit areas (Table 2-2), pit run surfacing, and limestone use. Because most of the pit run and limestone is used for reconstruction, which is equal across all alternatives, estimates of pit run and limestone was not adjusted across alternatives. Approximately 650,000 cy of pit run and 500,000 cy of limestone would be used during the planning period in all alternatives. Approximately 2,000,000 cy of pit run and 1,600,000 cy of limestone would be used in all alternatives by 2060.

In FY 2005, the ANF used 37,348 cubic yards (cy) of pit run and 24,264 cy of limestone on FS roads. For estimates of pit run use by 2020 and 2060, it was assumed that the FS would use 1,500 cy/mile for road construction in new corridors, 500 cy/mile for road construction in existing corridors, and 250 cy/mile for reconstruction. For estimates of limestone use by 2020 and 2060, it was assumed that the FS would use 250 cy/mile for road construction in new corridors, 500 cy/mile for road construction in existing corridors, and 250 cy/mile for reconstruction.

The wildlife and vegetation sections include more information on the overall effect of converting forested acreage to non-forest acreage through pit development.

Road management

Under Alternative A, roads are scheduled to be 20 percent open, 20 percent restricted, and 60 percent closed. Under Alternatives B, Cm, and D, the percentage of open/closed/restricted roads is projected to be roughly 33 percent in each category. On the ANF, hunting is considered to be the most important management tool available for controlling deer populations, and the new objectives allow for long-term distributed hunter access across the Forest.

Other roads may be identified for closure for a period of more than one year (ML 1 roads). These roads are identified as roads not needed for current use but possibly needed for future management access. The intent is to preserve the road investment while eliminating vehicular use. These roads are retained as part of the transportation system. Methods of closure include gates and signing, earth berms, boulders, scattering downed vegetation, scarifying, and seeding.

Total FS road system

The total FS roads system is largest in Alternative A, with declining levels to lowest in Alternative D. At the end of the planning period (2020), the total FS road system in Alternatives A and B expands over the current level by 24 percent. In Alternative Cm, it expands by 20 percent. In Alternative D, it expands by 16 percent. Expansion is largely a result of timber harvest scheduling in areas without access for ground-based logging systems.

Cumulative effects

The cumulative effects time period is 1986 to 2020. This will highlight the trends under the 1986 Forest Plan with those estimated through the LRMP. The primary activities for evaluation are the miles of new road construction and the acreage of land disturbed for gravel pit development. These two items create the greatest change both in short-term and long-term effects to other resources. The following assumptions are made in this analysis:

1. Road development scenarios for future mineral development on National Forest lands are used as identified in Table 2-4.
2. The oil and gas reserves are evenly spread within the proclamation boundary over all ownerships. Therefore, the road development scenario for private mineral development on all other lands within the proclamation boundary is prorated evenly with the percent of national forest lands projected for development (241,000/506,500 or 47%) or $234,000 \times 0.47 = 101,000$ acres.
3. Only miles of road construction on new corridors is used on National Forest lands.
4. Other private and public road development has been minor and is projected to continue through 2020 adding very little new construction. Often the private mineral development levels are adding roads that can be utilized for other uses.

5. Roughly 9,700 cubic yards of stone is available from 1 acre of gravel pit.
6. Past and projected use of NF gravel includes construction, reconstruction, and maintenance levels.
7. OGM roads built on other ownerships only utilize about 50 percent of gravel surfacing used for private OGM roads on NF land.

Miles of Road Construction – The past level (1986 to 2005) of National Forest System road construction is roughly 10 percent of the roads constructed within the Proclamation Boundary. The other 90 percent was contributed by private mineral development. Also, roughly 70 percent of new road construction has been on National Forest lands. Future projected levels show National Forest System road construction at roughly 52 percent of past levels in Alternatives D, 63 percent in Alternative Cm, 78 percent for Alternative B, and 89 percent for Alternative A.

Table 3-17. Cumulative miles of road construction and pit acreage consumed

(Past levels compared to future projected levels)

Source and Ownership	Past Levels 1986 to 2005	Future Levels 2006 to 2020			
		Alt A	Alt B	Alt Cm	Alt D
Miles of New Forest System Roads	180	120	105	85	70
Miles of Private OGM Roads on National Forest	1123	1922	1922	1922	1922
Miles of Private OGM Roads on Other Ownerships	528	859	859	859	859
Total Miles of New Roads	1831	2901	2886	2856	2851
Acres of Pits NF uses	80	70	70	70	70
Acres of Pits NF OGM uses	130	225	225	225	225
Acres of Pits Other Ownerships	33	51	51	51	51
Total Acres of Pits for gravel roads	243	336	336	336	336

3.3 Biological Environment—Direct, Indirect, and Cumulative Effects

One of the most significant undertakings since the 1986 Forest Plan was completed has been the national classification of terrestrial and aquatic systems into a National Hierarchical Framework of Ecological Units (McNab and Avers 1994). The terrestrial framework has been described by McNab and Avers (1994) and stratifies the earth into progressively smaller areas of increasingly uniform ecological potentials. The basic objective of the hierarchical framework is to provide a systematic method for classifying and mapping areas of the earth based on associations of ecological factors at different geographic scales (Cleland *et al.* 1997). The framework is used to improve efforts in national, regional, and forest level planning; and aids in consistent ecosystem management across National Forests. This framework assists in evaluating inherent capabilities of land and water resources and the effects of management on them (Cleland *et al.* 1997). This framework was used in the ecological context prepared for the species viability analysis (see Appendix E).

Depending on scale, ecological units are designed to exhibit similar patterns in: 1) potential natural communities, 2) soils, 3) hydrologic function, 4) landform and topography, 5) lithology, 6) climate, and 7) natural processes such as nutrient cycling, productivity, succession, and natural disturbance regimes associated with flooding, wind, or fire (Cleland *et al.* 1997). It should be noted that climatic regime is an important boundary criterion for ecological units, particularly at broad scales. In fact, climate, as modified by topography, is the dominant criterion at upper levels. Other factors, such as geomorphic process, soils, and potential natural communities, take on equal or greater importance than climate at lower levels.

Ecological units do not provide all the information needed to classify, map, and manage ecosystems. Ecological units address the spatial distributions of relatively stable associations of ecological factors that affect ecosystems. When combined with information on existing biotic conditions and ecological processes, the National Hierarchy of Ecological Units provides a means of addressing spatial and temporal variations that affect the structure, function and management potentials of ecosystems. Ecological units provide basic information for natural resource planning and management. Ecological unit maps may be used for activities such as delineating ecosystems, assessing resources, conducting environmental analyses, and managing and monitoring natural resources (Cleland *et al.* 1997).

Section 212G is a maturely dissected plateau characterized by sharp ridge tops and narrow valleys. Elevation ranges from 1,000 to 2,000 feet. A veneer of unconsolidated materials overlay bedrock. Thick deposits of clay, silt, sand, and gravel are present in wider valleys. Bedrock is composed of sandstone, siltstone, shale, subordinate conglomerate, occasional limestone, and coal. Precipitation ranges from 40 to 50 inches per year. Annual snowfall averages 50 to 100 inches. Mean temperature ranges from 46 to 48 degrees Fahrenheit. The growing season lasts from 120 to 150 days (McNab and Avers 1994). The section is comprised of approximately three million acres and is divided into two subsections; 212Ga (1.95 million acres) and 212Gb (1.65 million acres) (Figures 3-8 and 3-9).

The ANF lies completely within Subsection 212Ga and comprises about 26 percent of the acreage in the Subsection. Some of the differences between these two Subsections are that 212Ga receives about 5 more inches of annual precipitation than 212Gb, including about 16 more days with more than a 1/10 inch of snowfall and more than 14 inches more of total snowfall. Subsection 212Ga has a slightly shorter growing season than 212Gb. Subsection 212Ga contains wider plateaus and has less elevation differences (i.e., relief) between the ridgetops and valley bottoms than 212Gb. Subsection 212Ga has more poorly drained soils, more seeps and springs, and more miles of stream than 212Gb. Some glacial influences are present in 212Gb, which contains steeper side slopes than 212Ga. Subsection 212Ga contains 16 Landtype Associations (LTAs), the ANF encompasses 9 of these LTAs (Williams *et al.* 2005).

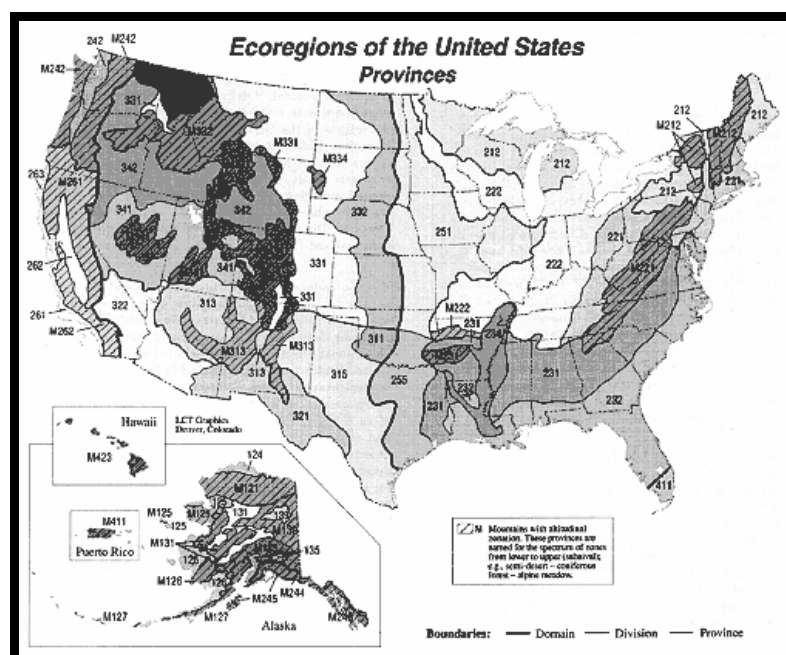


Figure 3-8. Ecoregions of the United States (McNab and Avers 1994).

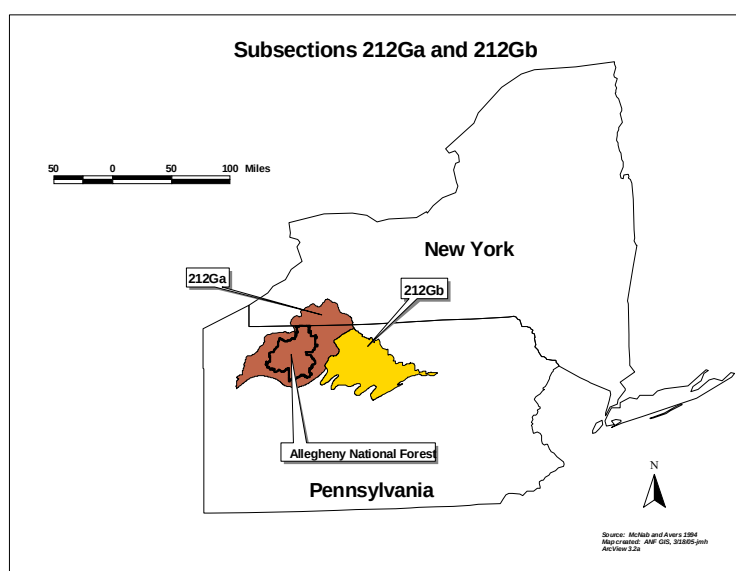


Figure 3-9. Subsections 212Ga and 212Gb.

The ANF proclamation boundary is shown within 212Ga, 2005.

3.3.1 Forest Vegetation

Several changes were incorporated in the forest vegetation portion of Chapter 3 between Draft and Final EIS. These changes were incorporated to address items the public commented on, clarify the intent or direction for particular management areas, and incorporate applicable new science that became available between Draft and Final EIS. The following summarizes changes that occurred:

- Updated various outcomes and outputs based on new SPECTRUM model runs that incorporated technical changes and changes to land allocations that would result in Alternative Cm (described in Chapter 2 and Appendix B of the FEIS).
- A discussion was added on the results of monitoring even-aged regeneration treatments that occurred on poorly drained soils in the past 20 years.
- A discussion was added on the potential long-term effects to forest vegetation from human-induced climate change.
- Clarification was added on the blend of silvicultural systems, and large areas of no management, that might be applied in MA 2.2.
- MA 2.1 features the use of uneven-aged management to sustain mid and late structural conditions, multiple age classes, and predominantly continuous high forest canopy, in contrast to management areas that feature even-aged management and age class diversity. Therefore, it was added to the grouping of MAs that are considered to feature structural attributes characteristic of older forests in the long term.

The desired forest vegetation condition in all alternatives includes sustaining a diversity of forest types, vegetative structural conditions, and age classes across the landscape. Restoration of understory vegetation and vertical diversity would occur in forested stands, and understories would contain multiple, diverse vegetative layers that are resilient and capable of sustaining well stocked, healthy hardwood forests in the long term. Both horizontal and vertical vegetative diversity would be provided on the ANF landscape, and a multi-layered vegetative forest canopy would be present in most riparian areas.

The forest vegetation discussion is divided into four broad categories. These include forest composition, forest age and stocking, forest health, and forest vegetation management. These aspects of ANF forest vegetation will play an important role in evaluating the environmental consequences of each alternative. Each of these topics will be covered in the same order in the affected environment, direct and indirect effects, and cumulative effects sections. Minor differences in quantities displayed in various tables are due to rounding of numbers. See the forest products section (3.4.6) for a discussion on lands suitable for timber production and forest products that might result from achieving the desired condition for each of the alternatives.

Affected environment

The affected environment begins with a discussion that provides background and a historic perspective relative to forest vegetation present on the ANF today. Following this background discussion, the affected environment discusses:

- Forest composition
- Forest age and stocking
- Forest health
- Forest vegetation management

Background and historical perspective

Almost all of the ANF is currently even-aged second growth, a result of the intensive harvesting that occurred between the 1890s and 1930s (Marquis 1975). Younger third growth stands on the ANF are a result of more recent management activities or natural disturbance such as windstorms. Even-aged stands have a relatively small difference in ages of the majority of trees. Because of extensive browsing by deer (1920s to present), seedling regeneration and diverse herbaceous and shrub understory vegetation is usually absent within the ANF.

Hobblebush, maple-leaved viburnum, spinulose wood fern, and shining club moss are examples of species that were relatively abundant under less deer browsing pressure. Other plant species (hayscented and New York fern, grasses and sedges, beech root suckers, and striped maple) fill the growing space vacated by browsed seedlings, cast dense shade at the forest floor level, and interfere with the establishment and survival of tree seedlings, along with other herbaceous and shrub understory vegetation.

Natural disturbance

Historically, wind, including tornados, was the primary disturbance in the Allegheny Plateau region, with drought and ice as secondary disturbances. Fire, from natural and human causes was also a force, especially areas burned by Native Americans near river drainages (Marquis 1994, p.11). Defoliation from native insects, forest diseases, and browsing by hare and deer (the latter common but not abundant during the 1920s), were undoubtedly part of the natural disturbance regime of the forest. Roosting and nesting of passenger pigeons (*Ectopistes migratorius*) may have also caused disturbances ranging from frequent, low-intensity crown thinning, to stand-initiation due to widespread limb and stem breakage and heavy nutrient loading (Ellsworth and McComb 2003). While many forest stands were mature or over mature, the pre-settlement forest was composed of stands of different age and size classes due to these natural disturbances. The variability in stand structure and composition represented the various stages of recovery from past disturbance.

Wind events

Tornados and/or extreme wind events occur somewhere on the ANF, almost every year. Both small-scale and large-scale disturbances characterize the natural disturbance regime of the Allegheny Plateau (Runkle, 1985, Ruffner and Abrams unpublished 2000, 2003). Smaller scale disturbances that result in smaller (less than 2 acre) gaps in the forest canopy are much more

frequent on the ANF than larger scale disturbances that create larger openings in the forest canopy (100s of acres). The natural disturbance rate within the Tionesta Scenic and Research Natural Areas (TSRNA) was estimated by Runkle (1981, 1982, 1985) to be 0.5-0.7 percent of the land surface area annually. The primary disturbance Runkle observed consisted of individual or small groups of trees that died and were replaced by younger trees in a process called gap phase replacement (Runkle in Davis, 1996, p. 167). Total area in gaps (land area directly beneath canopy opening) in the TSRNA was estimated to be 5 percent by Runkle (1982). Repeat disturbances affecting the same location may be common. Average gap size found by Runkle was 200 square meters, and strongly favors shade tolerant species such as sugar maple, beech and hemlock.

More recent estimates of the return interval based on actual tree ring analysis suggest that 10-20 percent of the canopy may be disturbed every decade depending on the topographic position of the stand (Ruffner and Abrams unpublished 2000, 2003). Specifically, Ruffner and Abrams found that larger scale blowdowns affect the upland and sideslopes on average every 30 years, while the more protected riparian sites experience less intense canopy disturbances with large scale blowdown occurring only once in the last 250 years. As an example, on the Tionesta Scenic and Research Natural Areas, major stand replacing wind events occurred in 1808, 1870, and 1985 (Bjorkbom and Larson 1977; Peterson and Pickett 1991). Several large tornados in 1985 created forest that is currently considered young on over 7,000 acres on the ANF, including 17 percent (nearly 700 contiguous acres) of the TSRNA old growth forest. This natural disturbance severely impacted nearly 11,000 acres of forest land on the ANF in several large tornado swaths. The damage consisted of large continuous areas as well as scattered patches of broken, splintered, twisted, and uprooted trees.

Ruffner and Abrams (unpublished 2000, 2003) concluded medium intensity disturbances impact the upland and exposed sideslopes of the Allegheny High Plateau every 210-630 years, a shorter interval than predicted from historical sources. Disturbances such as tornados, glaze storms, and thunderstorm downbursts affect the region several times a century, creating widespread pit-mound topography, large gaps, and unidirectional coarse woody debris. Other more common disturbances such as lightning and tree fall due to senescence affect the region nearly every decade. In general, small scale disturbances resulting in smaller canopy gaps (gap phase replacement) occur much more frequently than large scale disturbances that result in large, stand replacing canopy openings.

Since 1985 over 29,000 acres of wind or storm damage has occurred across the ANF. Significant wind events impacted vegetation on the Allegheny Plateau a number of times in just the past decade, including 1994, 1995, 1998, 1999 and 2003 (USDA FS, 2004a). Natural disturbance patterns inherent to the ANF such as catastrophic wind events can result in sizable areas of blown down trees and interrupt patterns of forest succession, causing instantaneous change from mature forest condition to young forest or non-stocked conditions.

Ice storms

Ice storms, sometimes called glaze storms have probably been a recurring disturbance factor on the Allegheny plateau for thousands of years. A significant glazing event or ice storm can be expected to occur on this forest every 50 years (Hough 1963). Damage may include breakage of limbs and branches sometimes causing canopy gaps and prolonged periods of reduced tree growth (Ruffner and Abrams unpublished 2000). A severe ice storm occurred on the ANF in March 1936 (Bjorkbom and Larson 1977). The damage from that storm remains evident in some areas of the ANF today. The last significant glazing event on the ANF was in 1965.

Native insects and disease

Native insects such as cherry scalloped moth (*Hydria prunivorata*), elm spanworm (*Ennomos subsignarius*), forest tent caterpillar (*Malacasoma disstria*) and oak leafhopper (*Croesia semipurpurana*) were present and caused periodic defoliation episodes prior to EuroAmerican settlement of the area. The pre-settlement patterns and severity of insect/disease outbreaks on the ANF are unknown, but they were probably cyclical with stand replacement events occurring at unpredictable intervals. Post-settlement insect and disease outbreaks most likely increased in quantity and intensity because of the introduction of non-native insects and diseases.

Anthropogenic (Human-caused) disturbances

Native American Indians lived here for thousands of years, at first hunting, gathering, and using fire to drive game animals and clear the land. Later agricultural-based villages were located in the rich fertile valleys along stream courses. The anthropogenic landscape in the Allegheny River Valley and its major tributaries during the Late Woodland period would have resembled a mosaic pattern of 1) crop lands near palisaded (wood fortified) settlements, 2) abandoned clearings with early structural species, and 3) open forest stands dominated by fire-adapted species such as oak and hickory (Chapman *et al.* 1982, Delcourt 1987, Clark and Royall 1995, Ruffner *et al.* 1997). About 250 years ago European settlers began arriving in the area that is now the ANF. From around 1890 to 1930, widespread logging and settlement changed the landscape. When the ANF was established in 1923, nearly all of the land was devoid of the original pre-settlement forest. The extensive timber harvesting, subsistence agriculture, and uncontrolled fires that occurred 75 -115 years ago created a generation of even-aged stand conditions on the ANF that are now in the mid-structural stage (50-140 years old).

Fire

Most fires can be considered an anthropogenic disturbance on the ANF, as fires in the area have historically been associated with human caused disturbances and ignitions.

The principal cause of fuel formation leading to natural fire in ANF northern hardwood ecosystems is broad-scale, storm driven windthrow of catastrophic proportions (Hough 1936; Runkle 1982). Conversely, along major oak dominated drainages, Native American Indians set frequent to periodic low-intensity fires (11 to 26 year frequency) (Ruffner, *et al.* 1997, Ruffner and Abrams 2002) that helped maintain the oak forest types present on the ANF today. Evidence suggests that this process of fire and oak recruitment occurred for hundreds and thousands of

years, but was broken during the early 20th century (Abrams 2005). The fire regime has changed for most oak forest and transition types on the ANF since settlement by Europeans. Current fire frequencies in the ANF are much lower than those during the pre-settlement period.

Following settlement by Europeans and widespread intensive harvesting of timber, fires primarily started on the ANF from railroad locomotives associated with logging activity (Marquis 1994, p.24). Some areas of the ANF experienced intense fires in conjunction with the use of railroads during early logging period (1900s), particularly the southernmost portion of the Forest. Due to the build up of woody material, it is suspected that some areas burned for long periods of time and at extreme temperatures.

Wildfires are not considered a significant concern on the ANF today. The nature of the fuels buildup in many forest types here is such that a sustained burn cannot often be maintained. Average annual precipitation of 40-45 inches, and the rapid rate at which woody debris decays, are the chief reasons that large fires are generally not considered an important disturbance factor on the ANF today.

Historical harvesting

Harvesting of timber on the Allegheny plateau began slowly in the early 1800s and accelerated in the mid to late 1800s, with the forest products being used for lumber. Many of the second growth stands within the ANF originated from a series of cuts occurring from the late 1800s to the 1930s. The first cut was usually for hemlock; another entry was made for the remaining sawtimber sized material, followed very shortly by the removal of the remaining trees for chemical wood. Hemlock bark was used in the tanneries, and some of the smaller trees were used in the local distillate plants. A shelterwood-like sequence of cuts created young even-aged stands with only a few scattered residuals. Each of these partial cuts was followed by a surge of advance reproduction that influenced the composition and character of the stands on the ANF today (Marquis, 1975, 1994).

Turn-of-the-century cutting brought about dramatic changes in the species composition of the ANF. A shift to shade-intolerant species occurred in many stands. Black cherry, only 0.8 percent of the pre-settlement tree species, represents 23 percent of the trees in today's forest. Red maple has increased from 5 to 28 percent, and sugar maple from 5 to 13 percent (Whitney, 1994, p. 196). Much of the ANF became dominated by even-aged black cherry, red maple and other shade-intolerant or mid-tolerant tree species.

Beginning in the 1920s custodial management occurred as much of the land that would become the ANF was acquired. Few records exist about management of the area for the following 20 years. Starting in 1940, records indicate some commercial harvest was occurring at a relatively low rate on the ANF, with harvest volumes of 4,500 MBF (1940) to 28,200 MBF in 1962. Many of these harvests were intermediate thinnings to improve quality of the maturing forest, or designed to regenerate poorly stocked, low quality stands.

Deer herbivory

White-tailed deer, nearly extirpated from Pennsylvania during the turn-of-the-century harvest period, made a remarkable recovery under protection from the Pennsylvania Game Commission beginning in 1907. By 1922, deer were causing serious damage to agricultural crops and forest reproduction (Marquis 1975).

Since the 1930s, herbaceous and shrub species richness and abundance have declined on the ANF primarily due to deer browsing (Hough 1965, Whitney 1984, Tilghman 1989, Jones *et al.* 1993, deCalesta 1994, Redding 1995, deCalesta 1998, Horsley *et al.* 2003). At the same time, species that are less palatable to deer, such as beech, striped maple, and ferns and grasses, expanded to occupy understory growing space vacated by species preferred by deer (Horsley *et al.* 2003). Composition of understory vegetation has shifted from shrubs and herbs to hayscented (*Dennstaedtia punctilobula*) and New York (*Thelypteris noveboracensis*) fern, grasses, beech brush, and striped maple. Also during this time the abundance and species richness of tree seedlings has declined (Marquis and Grisez 1978, Horsley and Marquis 1983).

Until recently, deer populations have been above the target levels established by state game managers and ecologists for the region to sustain ecosystem structure and health. For more information on the effects of white-tailed deer on forest development, see the discussion in the forest health and wildlife sections.

Introduced insects and diseases

Non-native invasive species (NNIS), or exotic species, have the potential to reduce native plant diversity and disrupt entire ecosystems. Exotic species are plants, insects, animals, or diseases that come from countries or continents outside of North America. Some non-native species have the potential to become invasive because the natural control agents that kept them from spreading uncontrollably in their native habitat are not present here. Introduced invasive species alter structure, function and processes in natural communities. Some of the more well-known exotic insects and diseases present on the ANF include European gypsy moth, chestnut blight, beech bark disease complex, and pear thrips.

Two introduced invasive species in particular are currently a concern on the ANF- beech bark disease complex and hemlock woolly adelgid. The beech bark disease complex has been an important influence on the ANF for more than a decade. While the hemlock woolly adelgid is not found yet on the ANF, it is present in Elk County, which contains the southeastern portion of the ANF. Other introduced insects present in the eastern United States that have not been documented on the ANF include the emerald ash borer, Asian long-horned beetle, and sudden oak death. The effects of these exotic insects and diseases, inadvertently introduced into the United States, pose serious forest health problems and will be discussed in greater detail in the Forest Health section.

Climate change

It is generally accepted that a global “greenhouse effect”, causing gradual climate change, exists. Increases in carbon dioxide in the atmosphere are indisputable (Gucinski *et al.* 2004), and evidence exists that the Earth is warming, with global temperatures having increased by 0.6°C during the 20th century (Iverson *et al.* 2004). Evidence is also mounting that climatic change over the past several decades may already be influencing species physiology, distribution, and phenology (Hughes 2000). Increased levels of atmospheric CO₂ concentration and changes in temperature and precipitation patterns could alter ecosystem functions, species interactions, population biology, and plant distribution. Changing climates will likely have effects on the suitable habitat for many tree species, resulting in possible major shifts in biomes (Iverson *et al.* 2004), generally northward in the mid-Atlantic Region (Lassiter, *et al.* 2000). Climate change will likely increase forest productivity (as tempered by other factors such as atmospheric deposition, moisture stress, nutrient availability, etc), alter natural disturbance regimes, cause shifts in appropriate habitats for trees, plants and associated wildlife, and likely alter outdoor recreation opportunities (Joyce *et al.* 2001).

Iverson and Prasad (2002) modeled five climate change scenarios to examine potential shifts in suitable habitat for major tree species in the eastern U.S. This study predicted that the optimum suitable habitat for more northern adapted species such as big tooth aspen, quaking aspen, sugar maple and paper birch would move north 20 km for more than 38-47 species, and more than 200 km into Canada for 8-27 species. At the same time, the optimum suitable latitude could move north for species presently situated further south, such oaks, walnuts, elms, and some pine species. Conversely, in the scenarios modeled, the optimum suitable habitat for five species including red maple, American beech and black cherry could move south. Although the five scenarios were in general agreement with respect to overall tendencies in potential future suitable habitat for tree species, significant variations occurred in the amount of potential movement in many of the species. The actual distribution of species would be determined by migration rates and measures humans take to intervene. As summarized by Iverson and Prasad (2002) and Gucinski *et al.* (2004) uncertainties exist and the actual redistribution of species that might occur is dependent on a number of factors. These include the rate at which climate change might occur (some species may not be able to respond and colonize new areas that rapidly), disturbance, fragmentation of the landscape, competition, seed dispersal mechanisms, and the abundance of exotic species potentially better suited for colonizing or invading sites that may have been suitable for migrating tree species. Along with shifts in forest species, shifts in associated flora and fauna could occur. Invasive species could likely gain in importance because many are adapted to disturbance.

Subsequent modeling completed by Iverson *et al.* (2004) concluded that there may be a substantial lag between the potential movement of suitable habitat and the potential for the species to migrate into the new habitat. The potential northward shift in optimum latitude of suitable habitat will likely outpace the actual northward migration of species. Habitat loss and fragmentation reduce the ability of natural systems to respond to changes in global climate or

other environmental factors. Conversely, humans can assist species in becoming established in new settings. Iverson *et al.* acknowledged great uncertainty with their model of species shifts, due to a number of biological and human-caused influences that were not included in the model.

In summary, global warming is likely affecting forest vegetation on the ANF and surrounding landscapes and region. This will over the long term (centuries) likely result in shifts in tree species composition and associated ecological communities. Uncertainty exists, however, as to what extent individual species and biotic communities will shift geographically or elevationally, and over what time frame.

Forest composition

Forest type distribution

There are approximately 80 tree species found on the ANF (Hays, *pers. comm.* 2002, adapted from Rhoads and Klein 1993). Roughly half of these can be considered relatively common on the ANF. Many of these species are extremely valuable for commercial wood products as well as wildlife habitat. Particularly valuable for both lumber and food for wildlife are black cherry and northern red oak. Recent decline and mortality have affected the relative abundance of hardwood species on those sites where various tree species are dying at different rates. Even though trees have died, it is probable that no tree species has been eliminated from any stand. Therefore, local and regional tree species richness remains the same.

The vast majority (90%) of the ANF consists of forest cover. Besides forested land, water comprises 2 percent, permanent shrub or grass openings comprise 3 percent of the landscape, and the remaining 5 percent consists of lands cleared for administrative sites, roads, openings for oil and gas facilities including wells, pipelines, and stone pits. Permanent openings are needed by wildlife for a variety of reasons and are a key component of a diverse landscape in a healthy forest ecosystem.

Forest type and age class data is summarized for ANF land only. Typically, stands are typed according to the species or species combinations that account for more than 50 percent of the total basal area of the stand. The ANF contains a diversity of forest types, with a total of 30 types represented. Tree species commonly found on the ANF include black cherry, white ash, tulip poplar, red and sugar maple, black and yellow birch, American beech, oaks, red and eastern white pine, and eastern hemlock.

For the purposes of this analysis, the forest types found on the ANF have been combined into 8 groups. These broad forest types vary in their acreage (see Table 3-18), and are distributed across the ANF as summarized below from satellite imagery, ANF stand data, and GIS maps generated in October 2005.

- Allegheny hardwoods, while distributed throughout, are most heavily concentrated in the eastern and central portions of the ANF.
- Northern hardwoods occur primarily in the north.
- Upland hardwoods are the most widely distributed forest type throughout the ANF.

- Oak primarily occurs in the western and southern portions of the ANF, abundant along major river drainages such as the Allegheny and Clarion Rivers and Tionesta Creek, where steep, drier slopes occur and periodic fires set by Native American Indians were likely an influence.
- Conifer and mixed conifer types are relatively minor components on the ANF. Hemlock usually does not occur in extensive stands but tends to be more linear as it is common along stream drainages. White pine occurs often on drier ridgetops in association with oak forest types. Red pine was planted in scattered old fields on the ANF during the 1930 through 1950s.
- Aspen is a minor component throughout the ANF.

It should be noted that areas typed as hemlock forest presently comprise only 2 percent of forested lands on the ANF. Due to its scarcity, this unique forest type is an important component in maintaining biodiversity on the ANF landscape. In addition to areas typed as hemlock forest, many hardwood types on the ANF contain an understory hemlock component that is important for wildlife and aquatic habitats, and aesthetic and riparian values.

Table 3-18. Present ANF forest types

Forest Type	Total Acres (Thousands)	Percent of ANF	Percent of Total Forested Land
Upland Hardwood (red maple, American beech, black cherry, black birch)	154.0	30	33
Allegheny Hardwood (black cherry, white ash, yellow poplar)	129.8	25	28
Oaks (northern red, white, chestnut, black, scarlet oaks mixed with other hardwoods)	75.4	15	16
Northern Hardwood (sugar maple, American beech, yellow birch, Eastern hemlock)	72.9	14	16
Mix (low stocking)	9.0	2	2
Hemlock	9.4	2	2
Conifer (spruce, red pine, white pine)	10.3	2	2
Aspen	2.7	<1	1
Total Forested Land	463.5	90	
Water	11.2	2	
Shrub or Grass Opening	16.1	3	
Developed for other Uses	26.1	5	
Total Non-forested Land	53.4	10	
Total ANF	516.9		

According to the information presented in Table 3-18, four major forest types dominate the ANF – upland hardwoods, Allegheny hardwoods, oak types, and northern hardwoods– which together comprise 93 percent (over 432,000 acres) of forested vegetation on the ANF. Upland hardwoods occupy the largest area (33%) with Allegheny hardwoods following second (28%). Together, upland and Allegheny hardwoods occupy over 60 percent of the ANF. Oaks (16%) and northern hardwoods (16%) occupy about half the area of the two dominant forest types. The remaining three forest type groups, along with a mixed group of less well stocked areas, are much less common and together comprise 7 percent of forested lands on the ANF.

Seedling regeneration species composition

Tree seedling composition is an important consideration, as it often determines the future composition of forest vegetation as overstory trees mature and die out or are harvested. Information about tree seedling species composition comes from several types of forestwide surveys, each conducted within a specific time-frame during the past 12 years (USDA FS, ANF 1995a, Appendix L and Appendix M; Morin *et al.* 2001; Morin, *et al.* 2006). The time-frame and results for each are summarized in Table 3-19. Each survey focuses on a slightly different facet of the tree seedling development question. When viewed together, they give a more complete status of tree seedling development on the ANF.

Table 3-19. Overstory and understory species composition, summarized for all ANF tree species

	1992 Survey (6,000 plots) ¹		1998-2001 FHM Survey (173 permanent plots)* ²		1992 Herbicide and Fence Survey (220 stands where Black cherry BA 30) ³		1992-2002 10- to 40-year old stand survey (4,100 ac.) ⁴	
	overstory	understory	overstory	understory	overstory	understory	overstory	understory
# of spp. (trees and shrubs)	56	72	40	36	30	35	44	70
# of commercial spp.	42	32	32	23	21	19	32	29
# of commercial spp. 5%	5	3	6	4	4	3	4	4
# of commercial spp. 2%	9	5	9	5	9	5	7	4
# of commercial spp. not in regen.	10	--	9	--	3	--	3	--

* FHM Survey only counts seedlings greater than or equal to 12" tall.

¹ USDA FS, ANF, 1995a, Appendix L

² Morin *et al.*, 2001; Morin *et al.* 2006

³ USDA FS, ANF, 1995a, Appendix M

⁴ Unpublished data analysis, 2004

Briefly, these surveys showed:

- Current overstory species distribution is not being maintained for forest types other than Allegheny hardwood, most likely due to deer browsing impacts over the past 70+ years. In the absence of management, there would be changes in forest type over time as stands develop following natural disturbance.
- Shifts are occurring between the overstory and understory species composition. In many areas, the understory species composition is dominated by black cherry, with lesser amounts of red maple and black birch. Forest type conversion will most likely occur in the northern hardwood stands surveyed, with the next stand containing a higher percentage of black cherry.
- Species richness is highest where deer densities were lowest (such as within fenced areas) at the time the stands originated, reflecting the ability of deer to selectively remove species preferred as food.
- Recent forest health monitoring on the ANF found American beech (susceptible to beech bark disease) was the most abundant seedling species on non-oak sawtimber plots, followed by black cherry, striped maple, birch, and red maple.
- In the oak type, red maple was the most abundant seedling species, followed closely by American beech.
- Oak-dominated stands may transition to stands dominated by other species unless steps are taken to ensure its inclusion
- Third growth stands on the ANF, or new forested areas that have resulted from even-aged management applied since the early 1960s, tend to be less diverse in species composition and contain a higher proportion of black cherry than the second-growth stands that resulted from the turn of the century harvesting, largely due to higher deer browsing impacts. More diverse third growth stands are anticipated in the future if recently reduced deer populations remain lower, and greater use of treatments to encourage tree seedling species diversity, such a release, are applied in regenerating areas on the ANF.

The overall lack of diverse seedling species representative of overstory tree species raises concerns about the long-term sustainability of forest types presently found on the ANF. Reforestation practices should be implemented to encourage establishment and development of a diversity of tree species representative of overstory trees. Studies conducted on the ANF have shown that the most important factor in successful natural regeneration is the amount of advanced seedling regeneration present prior to the final overstory removal (Horsley *et al.* 1994). Differences in species composition in today's young forests reflect the higher deer browsing impacts present when these third growth forests originated (1960s-1990s) versus the minimal browsing impacts that were present at the time of initiation of the majority of the existing ANF second growth forest (1880s-1920s) (Morin, *et al.* 2006). Other factors such as seed supply periodicity, seedbed conditions, light (including interfering vegetation), and predation on seed supply affect how well individual species regenerate. Black cherry is lower in food preference to deer (Horsley *et al.* 2003, Morin, *et al.* 2006), and therefore comprises a greater portion of stands which were regenerated when

deer browsing impacts were high. Additionally, black cherry produces seed more frequently, and the seed is viable longer in the soil than most other species present on the ANF (Horsley *et al.* 1994 and Horsley, unpublished 2005b).

In order to enhance seedling diversity and abundance, intensive reforestation treatments are presently applied on the ANF. In managed areas, local research and ANF seedling stocking data suggest that tree species and herbaceous diversity is improved where area fencing (often supplemented by an herbicide treatment to remove invasive, interfering vegetation) is used, and seedlings of some species preferred by deer begin to develop over time. Many reforestation treatments used today are specifically designed to reduce deer browsing impacts, remove invasive interfering vegetation, encourage regeneration of less common tree species, and release less common or unique tree species in order to better maintain seedling abundance and species diversity in regenerating areas.

On the Allegheny Plateau, acid deposition has resulted in lower soil pH levels, calcium and magnesium nutrients, and more available aluminum (Bailey *et al.* 2005), lowering the calcium to aluminum ratio. Some feel that tree seedling regeneration difficulties on the Allegheny Plateau can be attributed to soil nutrient changes associated with acid deposition. Sharpe and Halofsky (2004) observed higher hayscented fern abundance on soils with lower O (organic) soil horizon calcium to aluminum ratios and lower percent canopy cover. The lower canopy cover investigated by Sharpe and Halofsky resulted in increased sunlight on the forest floor, allowing hayscented fern plants to expand. They concluded that the percent cover of hayscented fern was strongly correlated with lower tree canopy densities (accounted for 53% of the fern variation), while O (organic) soil horizon Calcium to Aluminum ratios accounted for 18 percent of the variation in fern cover. The evidence presented in this paper suggests that fern may be able to occupy forest sites with more acidic (lower calcium to aluminum ratios) soils, but to what degree is uncertain.

However, the study by Sharpe and Halofsky (2004) did not consider the impacts of deer on understory forest vegetation, which is well documented in Pennsylvania and on the Allegheny Plateau (Hough 1965, Whitney, 1984, Tilghman, 1989, Jones *et al.*, 1993, deCalesta, 1994, Redding, 1995, deCalesta, 1998, Horsley *et al.*, 2003, USDA FS 2004e). Sugar maple seedling regeneration is highly preferred by deer, and hayscented fern and other plants not preferred as deer food expand in the presence of heavy deer browsing impacts (Horsley *et al.* 2003). Horsley *et al.* (2003) investigated the response of a number of herbaceous and woody understory plants at various deer densities. All sites in this study were equally affected by acid deposition, while deer densities were closely controlled. Ten years following overstory thinning (thinning increases light to forest floor by reducing overstory tree canopy cover), fern cover had increased the most under highest deer densities, suggesting that fern cover is highly correlated with increased light levels and high deer densities.

Forest age and stocking

Forest structure is a combination of the distribution of age classes across the landscape and within-stand vertical structure (the presence or absence of vegetation layers vertically arranged). Because of the even-aged nature of many stands, and the lack of understory diversity and structure due to past deer browsing, there is little within-stand vertical diversity on much of the ANF. Horizontal diversity, or diversity across the landscape, is a result of the spatial arrangement of forested and nonforested stands and the different age classes among forested stands.

Timber harvesting, rights-of-way, and natural openings have created both temporary and long-term gaps and variation in the forest canopy in the ANF, which affect horizontal diversity. The vast majority of the ANF is presently continuous, mature forest. See the plant and animal habitat section 3.3.2 for further discussion on vegetation structural classes from a habitat standpoint.

Age class diversity

Generally, commercial timber harvest has been the means by which the Forest manages age class distribution on lands available and suitable for commercial timber management. Much of the scheduled forest management activity in the past two decades on the ANF has emphasized creation of early age classes. The vast majority of early age classes result from management activities that occurred in MAs 1.0 and 3.0. Some early age classes on the ANF were created through natural disturbances, such as the tornados that impacted nearly 11,000 acres on the ANF in 1985.

Table 3-20 shows present age class distribution by forest type of forested lands on the ANF. As can be seen from the Table, the majority of the ANF is older than 80 years (60%), with more than half (57%) of the ANF in the 81-110 age class. Eight percent of the ANF is in the youngest age class (0-20 years old), a result of even-aged regeneration harvests and natural disturbances, and approximately three percent is presently older than 110 years. Presently, only 2 percent of the ANF is providing transitional seedling habitat. The uniform, even-aged second growth forest of the ANF is similar to most of the second growth forest found throughout the region. Remnant old growth areas in excess of 300 years old comprise less than 1 percent of forest vegetation on the ANF.

Table 3-20. Present age class distribution by forest type, ANF

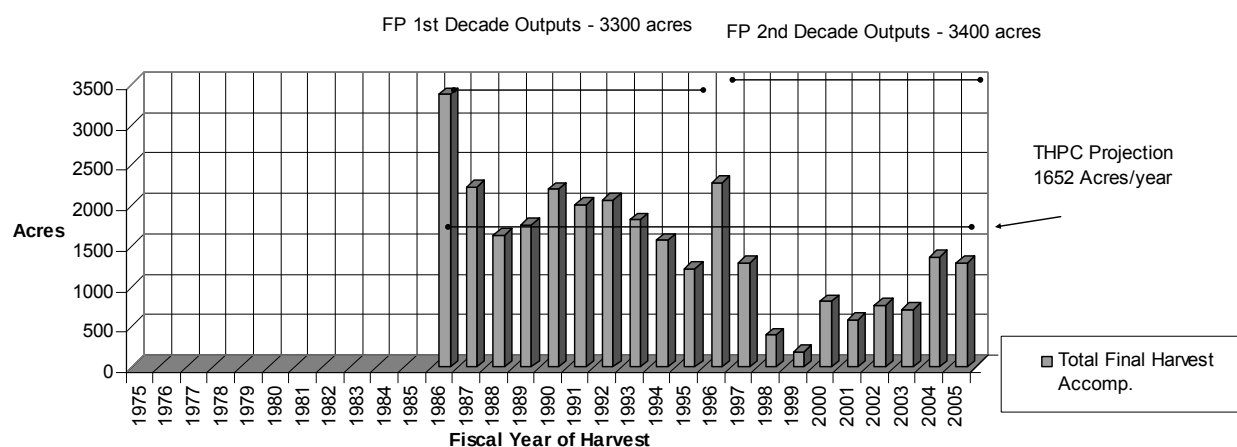
Forest Type	Age Class (Thousands of Acres)						
	0-20	21-50	51-80	81-110	111-140	141-300	301 +
Upland Hardwood	9.0	6.6	42.4	93.3	2.7	0	0
Allegheny Hardwood	22.1	14.9	29.9	62.0	0.9	0	0
Oaks	1.3	0.6	19.0	51.5	3.0	0	0
Northern Hardwood	3.6	4.1	13.3	46.6	4.0	0	1.3
Mix (low stocking)	0	0	2.5	6.3	0.2	0	0
Hemlock	0	0.1	2.2	4.3	0.8	0	2.0
Conifer	0.2	0.9	7.2	1.9	0.1	0	0
Aspen	0.5	0.5	1.5	0.2	0	0	0
Total Forested Land	36.7	27.7	118.0	266.1	11.7	0	3.3
% of Forested Land	8	6	26	57	3	0	<1

Allegheny hardwoods, followed by upland hardwoods, comprise the largest portion of the 0-20 year age class, whereas northern hardwoods and hemlock forest types comprise the largest proportions of the oldest age classes. With the exception of shorter-lived aspen and younger conifer (generally planted red pine or other conifer species) types, the bulk (57%) of forest types on the ANF falls within the 81-110 age class.

Young forest (0-20 years old) is transitional in nature, and occurs from wind, fire, disease, animals, and anthropogenic disturbance. Only 8 percent of the ANF is presently in the 0-20 year old age class compared with the 15 percent projected in the 1986 Forest Plan if the ANF had conducted final harvests at the maximum level (~3,300 acres per year; see USDA FS, 1986a, p. 4-18). Most of this harvest would have come from the 81-110 year age class, serving to reduce the imbalance that presently exists. If the existing poor distribution of age classes continues to age, gradual declines in timber and mast production capability will occur, and the forest will become more susceptible to insect and disease outbreaks and other age-related problems.

Figure 3-10 displays how much seedling (0-10 year old) age class has been created annually since 1986. As can be seen from the figure, the amount of seedling age class created declined in the early 1990s. Additionally, the amount of seedling age class has fallen below levels predicted in the Harvest Capability Report (USDA FS 1995a, pp. 38-52) since 1997.

Older forest (greater than 140 years old) provides compositional and structural values not found in younger communities. Important attributes and values to provide in areas managed for late structural and old growth conditions include large trees, canopy gaps, complex vertical structure with multi-layered vegetation, dead standing trees, and down woody debris. Presently less than 1 percent of forest vegetation on the ANF is greater than 140 years old.



Actual Accomplishment for 1986 - 2005 is 43% of the Forest Plan Projection or 86% of THPC Projection

Figure 3-10. ANF seedling age class (0-10) created by year (acres)

Several estimates have been provided for the amount of time it takes old growth to develop naturally in hardwood stands, such as the second growth hardwood stands on the ANF. Hemlock –hardwood old growth is believed to develop after 250 to 350 years (Haney and Schaadt 1996, p. 78). These processes could take even longer given impacts created by the introduced beech bark disease, potential impacts from the introduced hemlock woolly adelgid, and excessive browsing impacts from deer, which disrupt natural succession and stand development processes. While some of these characteristics, such as large diameter trees and old growth within-stand structure can be enhanced or promoted through silvicultural activities (Oliver and Larson 1996, pages 281-282; Runkle 1991; Trombulack 1996; Franklin and Van Pelt, 2004; Jenkins *et al.* 2004; Vora 1994; Singer and Lorimer 1997; Nyland *pers. comm.* 1998 and 2004; Litvaitis 2003; Lorimer and Frelich 1994), other old growth values can only be achieved over time.

Two notable remnant (unharvested) forest areas remain on the ANF - Hearts Content Scenic Area and Tionesta Scenic and Research Natural Areas (TSRNA). These remnant old growth areas comprise less than 1 percent of forest vegetation on the ANF. The forests in the TSRNA have been influenced by the same natural disturbances affecting the Allegheny Plateau for thousands of years, and experienced major stand replacing wind events three times in the past two centuries that created younger, second growth forests in portions of these areas (Bjorkbom and Larson 1977; Peterson and Pickett 1991). Nearly all of the original old growth forest remaining in TSRNA consists of northern hardwoods, dominated by hemlock and beech. The beech bark disease complex, is currently of particular concern in the TSRNA old growth areas, where American beech is the second most common tree species and comprises 35 percent of the trees greater than 10 centimeters in diameter (Zimmerman, 1984). The killing front of the beech bark disease was evident in TSRNA in 2002, and an estimated 50 percent of the beech trees in the area have suffered mortality since 2002 (MacKenzie, unpublished 2005b and *pers. comm.* 2004). This disease complex is substantially altering forest structure in large portions of the TSRNA. The looming hemlock woolly adelgid is another great concern for the northern hardwood forest in the TSRNA, where eastern hemlock is the most common tree species, and comprises 42 percent of the basal area in trees greater than 10 centimeters in diameter (Zimmerman 1984).

During the past two decades of plan implementation, a total of 5,800 acres have been designated for development of future late structural and old growth characteristics. These areas consist of isolated stands, or groups of stands scattered across the ANF. The bulk of previously designated areas fall within MA 3.0, followed by MAs 6.1, 6.2, 1.0, 2.1 and 8.5.

Stocking

One of the primary objectives of ANF forest management is to maintain healthy, moderately to well-stocked stands in forested conditions capable of providing a variety of products and amenities (LRMP, Part 1, Vegetation Management Goals). One way of measuring how well a site is occupied is to evaluate a measure of stand stocking, or relative density (a measure of site utilization that accounts for variations in size and species composition [Marquis *et al.* 1992]). Table 3-21 shows that nearly half (45%) of the ANF is considered well stocked forest. Another 27 percent is presently considered moderately stocked forest, while only 3 percent is considered to be in a condition that falls far below the level of stocking that is considered to be fully occupying the site. Seventeen percent falls into a mixed category, which for the most part consists of third growth (less than 50 years old) regenerated forest that is typically well stocked.

The remaining 8 percent is considered non-forested. In total, nearly 80 percent of the ANF consists of moderately to well-stocked forest stands.

Understory/midstory vegetation

Stands with a high degree of vertical diversity typically develop multiple vegetative layers and are generally characterized by a diverse overstory, woody mid-story layers and a well developed understory. Structural diversity has important implications to wildlife, because many species, particularly songbirds, reptiles and amphibians, have requirements for different amounts of structural diversity. On the ANF, vertical diversity has been greatly affected by past and on-going deer browsing and interference from native invasive plant species, and is therefore lacking in many areas.

Vertical and horizontal structure of the vegetation changes over time. Recent forest health surveys completed on the ANF indicated more than half of the forest is in the understory reinitiation phase (Morin *et al.* 2006). During understory reinitiation, gaps form in the formerly closed canopy, where decline or tree mortality has occurred. These gaps allow sunlight to reach the ground stimulating the understory plants and seeds in the seedbed. Theoretically, shrubs and tree seedlings should eventually occupy these gaps, creating a multi-storied stand. However, on the Allegheny Plateau, deer repeatedly browse wildflowers, herbaceous vegetation, shrubs and seedlings, and have virtually eliminated the shrub understory and greatly reduced the number of seedlings and herbaceous plants (Tilghman 1989; Jones *et al.* 1993; deCalesta 1994; deCalesta 1998; Horsley *et al.* 2003; Whitney 1984). Only 9 percent of the ANF (Table 3-22) presently contains adequate seedlings to sustain forest cover (Morin *et al.* 2006), thereby reducing the potential for improved vertical diversity.

Table 3-21. Present stocking levels of forest vegetation more than 50 years old on the ANF

Relative Density	Age	Thousands of Acres	Percent of FS Lands
Low (0-44%)	51+	14.0	3
Moderate (45-74%)	51+	136.9	27
High (>75%)	51+	228.0	45
All-Mix	<51	84.6	17
Non-forested Land	N/A	42.2	8
Total ANF Land ¹		505.7	

¹ Does not include areas classified as water.

Table 3-22. ANF understory vegetation conditions based on surveys at three different scales and points in time

Understory Vegetation Category	1992 6,000 Plot Survey in MA 3.0 (307,000 acres) ¹	1994-1996 Mortality Stand Data (~19,000 acres) ²	1998-2001 FHM Data (~480,000 acres) ^{3*}
% with interfering plants	70%	93%	n/a
% with adequate tree seedlings	23%	8%	9%

¹ USDA FS, ANF, 1995, Appendix L, Table 6

² McWilliams et al. 1996

³ Morin, et al. 2006

* FHM protocol counts only those seedlings ≥ 12 inches tall

Forest health

The following discussion summarizes a number of factors that have affected the health of forest vegetation on the ANF in the past, or are anticipated to in the future. Though a number of forest health influences are discussed here in the affected environment, the environmental effects discussions will focus on a few measures relative to forest health.

As trees mature, they naturally become more predisposed to decline and mortality from insect and disease infestations, and less resistant to stressors (Grief and Archibold 2000). Tree decline and mortality generally occurs in physiologically mature trees at or after the age when their ability to recuperate from external stresses is reduced (Manion 1991 p. 330-335; Nyland 1996, p. 454-458). Maintaining structural-age class and community composition diversity at the landscape level helps reduce the risks of insect and disease outbreaks and subsequent mortality (Nyland 1996 p. 466).

The age, structure, and maturity of the forest on the ANF are fairly uniform. This uniform, mature second growth forest is vulnerable to damage from repeated natural stresses (droughts, late spring frosts, open winters, native defoliators such as elm spanworm, cherry scallop shell moth, fall cankerworm, and forest tent caterpillar) and exotic insects or diseases (beech bark disease complex, pear thrips, gypsy moth, and hemlock woolly adelgid).

A variety of insects, diseases, droughts, windstorms, and local site nutrient limitations are affecting tree and forest health on the Allegheny Plateau. Some tree species or areas of the ANF are being affected disproportionately, particularly when subjected to multiple stresses over a relatively short period of time (several years). The health of the northern hardwood forest type on the ANF, dominated by a combination of American beech, sugar maple and eastern hemlock, is of particular concern. American beech is subject to mortality and decline from the beech bark disease complex, sugar maple on the unglaciated Allegheny Plateau is limited by site nutrient characteristics and currently subject to decline, and eastern hemlock is at risk from future invasion of the hemlock woolly adelgid.

Deer herbivory/interfering plants

On the Allegheny Plateau, excessive deer browsing and interfering plants have severely limited tree seedling development and growth, and healthy young trees may not be replacing trees that die, interrupting the natural cycle which normally maintains continuous forest cover on the land (Horsley *et al.* 2003). Normally, openings created in the overstory tree canopy, such as those created by individual trees dying would allow for increased plant growth on the forest floor. However, on the Allegheny Plateau, extensive and selective deer browsing has impeded the growth of seedlings and saplings, impacting natural regeneration and reforestation following natural or anthropogenic disturbances (Whitney 1984, Tilghman 1989, Jones *et al.* 1993, deCalesta 1994, Redding 1995, deCalesta 1998, Horsley *et al.* 2003). This legacy of extensive and selective browsing by deer has decreased the number of other hardwood seedlings, while increasing the abundance of beech seedlings and suckers (which are susceptible to beech bark disease complex mortality), striped maple, fern and grass that interfere with the establishment and survival of a diversity of seedlings (Horsley *et al.* 2003). Consequently, forested stands throughout the ANF lack the understory conditions that normally exist or that would result following natural disturbances, which raises concerns over the future sustainability of forested ecosystems on the ANF. Many other desirable native plants (including shrubs and some wildflowers) have been similarly affected by selective deer browsing thus reducing plant diversity.

When the 1986 Forest Plan was prepared, approximately 50 percent of the ANF was estimated to have interfering plants abundant enough to limit tree seedling development and require treatment (USDA FS 1986a p. 4-37). Data from more recent forestwide vegetation monitoring efforts (Table 3-22) suggest a trend in increasing interfering vegetation in the ANF forest understory.

Surveys in 1992 determined that close to 70 percent of all MA 3.0 land is stocked with enough ferns, grass, striped maple, and beech brush to interfere with desired tree seedlings and herbaceous vegetation (Table 3-22) (USDA FS 1995a, Appendix L, Table 6). Only a small portion (23%) of the ANF has adequate understory stocking and the diversity of tree seedlings necessary to replace dying trees with a well-stocked forest canopy in the future. Close to 70 percent of all riparian areas are also stocked with enough ferns, grass, striped maple, and beech brush to interfere with desired tree seedlings and herbaceous vegetation (USDA FS 1995a, Appendix L, Table 9), and only 10 percent of riparian areas are adequately stocked with tree seedlings on the ground to replace forest cover with desirable tree seedlings if the overstory were to experience significant mortality or decline (USDA FS 1995a, Appendix L, Table 6 and attachment 4, p.2).

Additional surveys conducted during 1994 on the ANF (McWilliams *et al.* 1996) (Table 3-22) in areas experiencing forest decline indicated that only 8 percent of the sampled stands had adequate tree regeneration to successfully restock areas as described by Horsley *et al.* (1994). In the 1994 survey, vegetation that interferes with tree seedling development and growth was present in sufficient quantities to require treatment, as described by Marquis *et al.* (1992) and Horsley *et al.* (1994), in 93 percent of the stands evaluated.

Forest health monitoring data collected in 1998-2001 indicates adequate tree seedlings are present on slightly over 9 percent of the ANF (Morin *et al.* 2006) (Table 3-22). This most recent data found American beech to be more than twice as abundant as any species in both the seedling and sapling classes, with nearly as many stems/acre in each size class as all other species combined. This is because American beech is a prolific sprouter and less palatable (preferred) by deer. Beech suckers can become established in abundance even under high deer browsing impacts to the point that they interfere with a diversity of desirable seedling regeneration. This has raised concerns about sustaining areas well stocked with canopies of desirable, healthy tree species (Morin *et al.* 2006). American beech trees and associated root suckers are susceptible to the beech bark disease complex. The root sprouts that result following decline and death of larger beech trees will die off before maturing enough to provide high forest cover and other benefits such as mast for wildlife.

When interfering plants are this abundant, local information indicates that tree seedlings have a limited ability to become established. When tree seedlings are not present on the ground and their development is severely restricted by interfering plants, natural catastrophic events (such as tree mortality) may not foster tree seedling establishment and development of well stocked future forests, particularly where activities to promote development of desirable tree seedling regeneration are not permitted. It is very difficult for vigorous young trees to grow from seed, gain dominance over the interfering plants, withstand deer browsing, and replace trees that die. Trees that die will most likely not be replaced by similar species or, in many cases, by any species of vigorously growing tree seedlings that are capable of growing to replace them.

In 2003 the Deer Management Assistance Program (DMAP) was initiated on the ANF, allowing additional antlerless licenses to be issued to meet landowner goals (see the wildlife section for further discussion on DMAP). As a result, the deer population on the ANF has dropped more than 17 percent. Although browsing intensity has declined, the understory response lags behind the population drop (deCalesta 2005). Interfering understories that are well established as a result of a legacy of deer browsing impacts will still need treatment to encourage a diversity of tree seedlings and herbaceous vegetation to become established. If current programs to sustain lower deer populations remain in effect, it is possible that one of the most important challenges to regeneration success on the ANF will be eased during the implementation period for the LRMP, and that improvements in understory health and diversity may become evident over time. However, it is also possible that deer impacts will return to historic and challenging levels. Regardless of future deer impacts, interfering understories that are well established as a result of the past legacy of deer browsing will still need to be treated to encourage establishment of a diversity of tree seedlings and herbaceous vegetation.

Insect infestations/defoliation

Between 1965 and 1984, insects had a relatively small impact on the ANF. A substantial portion of the ANF and lands within the proclamation boundary were repeatedly defoliated between 1984 and 1998 by both native and exotic insects (Table 3-23), greatly exceeding that which occurred between 1965 and 1984. Since 1985, more than half of the ANF has been defoliated two or more times, and over 15 percent has been defoliated three or more times. Between 1985 and 1995, more than 248,000 acres of the ANF were sprayed with insecticide (primarily the biological insecticide *Bacillus thuringiensis* var. *kurstakii*) to reduce defoliation from gypsy moth, elm spanworm, and forest tent caterpillar. Without spraying, tree mortality/decline would have been much higher. Very little defoliation has occurred since 1998 (Morin *et al.* 2001, Morin *et al.* 2006).

Two or more summers of defoliation can cause dieback or even tree mortality. Canopy disturbances such as defoliation episodes, particularly when concurrent with droughts or other abiotic stressors, may compound the injury to the tree ultimately causing unexpected mortality (Morin *et al.* 2001, pg. 59; Morin *et al.* 2006).

Table 3-23. Cumulative defoliation on land (private and National Forest system) within the ANF proclamation boundary

# of Years Defoliated	1984 through 1998 ¹		1999 – 2003 ²	
	Thousand Acres	% of ANF	Thousand Acres	% of ANF
0	100	13.4	684	93.7
1	263	34.8	46	6.3
2	271	36.7	<.1	<.1
3	85	12.9	-	-
4	10	2.0	-	-
5	1	.2	-	-

¹ Source: Morin *et al.* 2001

² Source: Forest Health Protection

Defoliations on the ANF were compounded by four significant droughts that occurred between 1987 and 2001 (Palmer Drought Severity Index below -1.0). As a result of defoliation and severe drought, crown die-back and mortality has occurred with many tree species across the ANF. Across the landscape and over time, these stressors and related mortality have contributed to the current condition of ANF forest ecosystems.

Native insects

Native insects and diseases are important components of a natural forest ecosystem. Native insects and diseases have many beneficial effects that include helping to decompose woody vegetation, contributing to diversity, enhancing habitat for plants and animals, and assisting the ecological succession of the forest. However, large outbreaks of native insects and diseases can have negative impacts such as reducing tree growth or value, causing large-scale tree die-back or mortality, decreasing water quality, increasing fire risk, creating safety hazards, diminishing scenic views, and reducing biodiversity.

Between 1982 and 2003, native insects that reached epidemic levels on the ANF include the cherry scalloped moth (*Hydria prunivorata*), elm spanworm (*Ennomos subsignarius*), forest tent caterpillar (*Malacosoma disstria*) and oak leafhopper (*Croesia semipurpurana*) which cumulatively defoliated approximately 840,000 acres.

Peach bark beetle (*Phloeotribus liminaris*)

Peach bark beetle is a native bark beetle that has affected peach and cherry orchards in the northeastern U.S. since the mid-1800s. Localized outbreaks in black cherry can occur after periods of drought, following heavy defoliation, windthrow, where black cherry trees are weakened or under stress, or where freshly cut slash exists that allows the beetle to increase to the point of overcoming the natural defenses of vigorous trees. The insect causes gummosis and a decrease in wood quality and value. Trees are rarely killed, but are usually weakened which may predispose the tree to other stresses or insects. The peach bark beetle is not presently considered a significant concern on the ANF (Acciavatti, *pers. comm.*, 2005). The value of black cherry from the ANF does not appear to be greatly impacted by the beetle.

Exotic insects

Between 1985 and 1996 exotic insects that reached epidemic levels on the ANF include the European gypsy moth (*Lymantria dispar*) and pear thrips (*Taeniothrips inconsequens*).

Gypsy moth (*Lymantria dispar* L.)

This insect was introduced from France to the United States in 1869. The first defoliation outbreak occurred in 1889 (McManus *et al.* 1989). Oak trees (especially white and chestnut oak) are the preferred host. Oak and mixed oak forest types are most susceptible to this non-native pest on the ANF, but the mixed hardwood and northern hardwood types may also be affected in severe outbreaks.

In the late 1980s and early 1990s, gypsy moth caterpillars were defoliating thousands of acres in the western and northern sections of the ANF. During this time period, numerous areas on ANF land were treated to reduce gypsy moth populations. A population crash occurred in 1993, due to a virus (*Nucleopolyhedrosis Virus*) specific to gypsy moth, along with the fungus *Entomophaga maimaiga*. High humidity, frequent periods of rain, and fairly constant temperatures between 14°C to 26°C are needed for the fungus to germinate and spread (Reardon and Hajek 1993). With the exception of a small amount of light defoliation in 1999, the last observed gypsy moth defoliation on the ANF was reported in the spring of 1993.

Pear thrips, *Taeniothrips inconsequens* (Uzel)

This introduced species was first noted in California in 1904 and now occurs throughout the United States. It is a tiny insect that feeds on the expanding buds of many trees, but particularly affects sugar maple and black cherry. The pear thrips insect serves as a vector for a fungus that enters the thrips-created wound on the leaf and causes necrosis, deformity, and discoloration of leaf tissue. It was first observed in Pennsylvania in 1912, feeding on fruit orchards in Erie County. It was not identified as a forest pest until 1979 when, following heavy defoliation in 1978, it was found to have caused severe leaf damage on an estimated 73,000 acres in Pennsylvania. There have been two cycles of recent pear thrips damage on the ANF; one in 1989, and one in 1993. Since 1994 the pear thrips population on the ANF has remained low.

Disease

Native diseases

A number of native diseases exist that are a natural component of vegetative communities and normal ecosystem functions on the ANF. One example is *Nectria Galligena*, a major cause of cankers and mechanical stem failure on yellow and sweet birch, which coincidentally impacts American beech trees in conjunction with the introduced beech scale insect. Most birch trees on the ANF become infected with the *Nectria* fungus and few exceed 60 years of age (Morin *et al.* 2006).

Exotic diseases

Some of the more well-known exotic diseases that have affected forest vegetation on the ANF include chestnut blight, Dutch elm disease, butternut canker, and beech bark disease complex. The most significant disease currently affecting forests of the Allegheny Plateau at higher than normal background rates is beech bark disease complex.

Beech bark disease complex

Beech bark disease is an introduced disease complex currently causing substantial beech mortality on the ANF and in the eastern United States. It is an insect-fungus complex composed of European scale insect (*Cryptococcus fagisuga*) and the exotic canker fungus (*Nectria coccinea* var. *faginata*), or the native canker fungus (*Nectria galligena*). Two waves of tree infestation or colonization actually occur. The first is the wave of colonization by the scale insect known as the “Advancing Front.” The second, known as the “Killing Front”, occurs as the fungus colonizes the

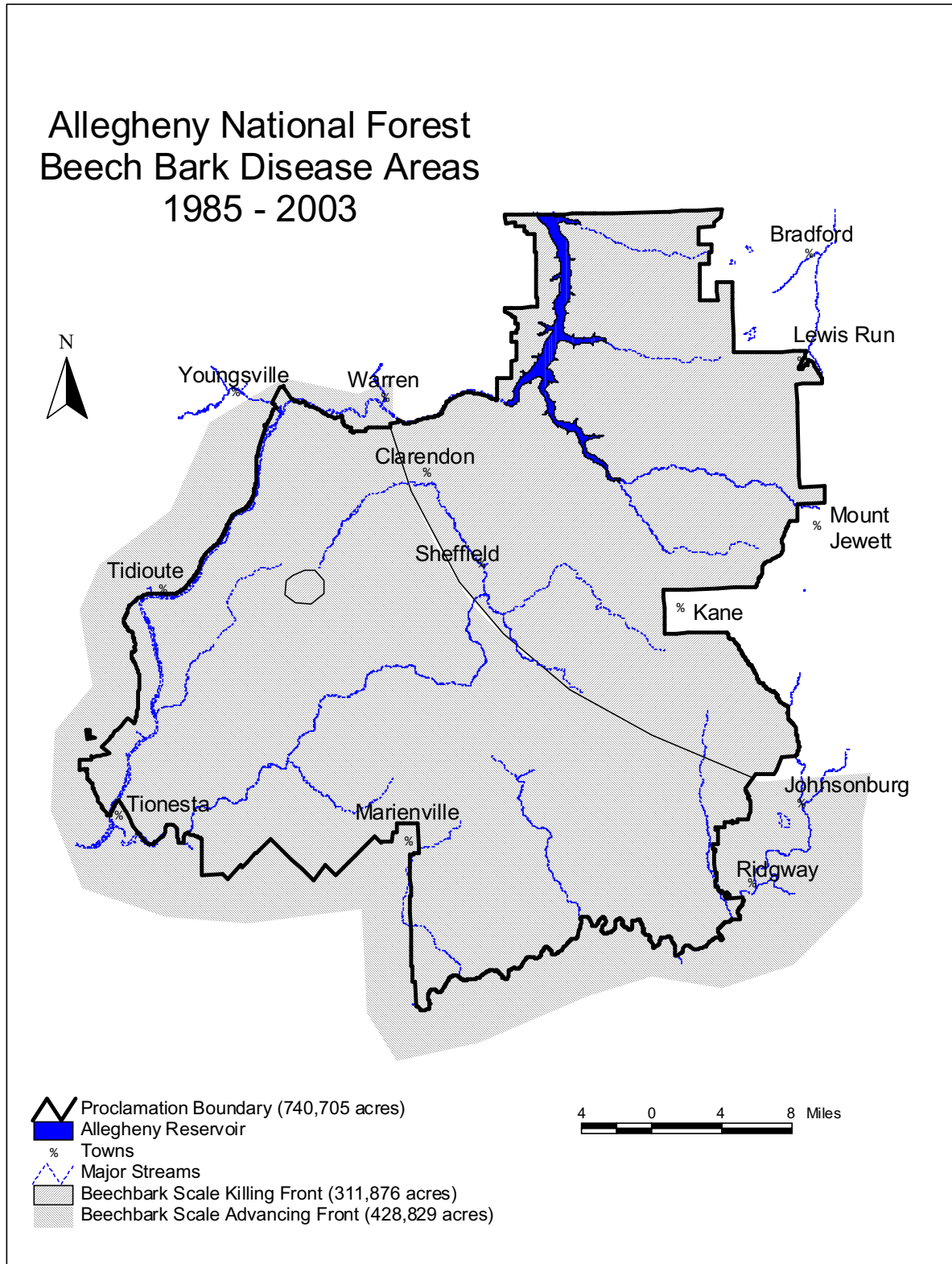
feeding wounds left behind by the scale insects. *Nectria* infections result in lower tree vigor, or the resulting cankers may coalesce to girdle and kill the tree.

The disease complex affects the largest beech trees first, which contain higher nitrogen content in the bark, but as the duration of the disease present in affected stands increases, trees with lower bark nitrogen concentrations are affected (Latty *et al.* 2003). This complex results in significant beech mortality, with an understory response of increased beech root sprouting. These root sprouts, like the parent trees from which they originate, are also susceptible to the disease. The dense regeneration of beech within the infested stands prevents the regeneration of other hardwood or conifer trees (Forrester *et al.*, 2003; Hane 2003, Latty *et al.* 2003). This increase in the amount of susceptible beech stems in affected areas, may potentially lead to a second beech bark disease outbreak of more serious impact than the first (Otrofsky and McCormack 1986). As a result, the productivity of the stands decline as the disease progresses, decreasing stand health.

Recent monitoring on the ANF indicated that the percent of standing dead beech is more than two times greater inside the killing front compared to outside (Morin *et al.*, 2006). Long-term studies in New Hampshire have found that management directed toward removing poor beech trees over a period of decades can produce areas where stand level health is significantly improved, the effects of beech bark disease are reduced, and the basal area of beech trees resistant to the disease complex is increased (Leak 2006).

The scale insect was detected on the ANF in the early 1980s, and is now present throughout the entire ANF. The killing front presently covers approximately 42 percent (see Figure 3-11) of the ANF (Morin *et al.* 2006). Recent surveys completed in portions of the ANF where the BBD was first detected indicated a 66 percent loss of beech basal area greater than 6" diameter between 1991 and 2003 (MacKenzie unpublished 2005a). BBD is of particular concern in northern hardwood stands with a large beech component. In New England where beech bark disease complex has been present and killing American beech for over 50 years, on the average half of the trees die, and only 1 percent of the trees appear immune to the complex (Houston 2005), though some will demonstrate partial resistance. The overall effects of this widespread beech mortality on forest composition and structure on the ANF are not fully understood yet. Sustaining healthy American beech has been identified as an LRMP research need (see table 16 in the monitoring section of the LRMP).

Figure 3-11. Beech bark disease complex progression of advancing and killing fronts on the ANF, 1985-2003



*Chestnut blight (*Cryphonectria parasitica*)*

This fungus was probably introduced from Asia and first reported in the United States in 1904. Within 50 years the fungus occupied the tree's entire range and had killed 80 percent of the American chestnut (Kuhlman 1978). Nearly all the remaining live trees were infected with the fungus and dying. Prior to the infestation, the American chestnut was a major component of the eastern hardwood forest, and comprised about 3 percent of the trees present on the ANF (Whitney 1994, p. 196). This tree, which once grew up to 120 feet tall and over 7 feet in diameter, now rarely attains heights over 30 feet, with diameters up to 6 inches before the fungus kills the stem. The process starts over when the tree resprouts. The American Chestnut Foundation is working with researchers to develop blight resistant American chestnut trees, while the ANF is cooperating with the American Chestnut Foundation in testing susceptibility of potentially blight resistant American chestnut trees in forested ecosystems. Some time in the future the American chestnut may return to the eastern hardwood forest.

Drought

On the ANF precipitation is normally plentiful throughout the year and averages 40 to 45 inches per year. The Palmer Drought Severity Index (PDSI) indicates that droughts (PDSI less than or equal to -1) occur on the ANF every three to six years (Morin *et al.* 2001). Between 1972 and 1987 the Allegheny experienced a relatively drought free period, but four significant droughts occurred between 1987 and 2001 (Morin *et al.* 2001).

Ozone

Recent forest health monitoring completed on the ANF included assessing damage to forest vegetation from ozone, a byproduct of industrial development. Impacts to ozone-indicator plants, such as black cherry and blackberry on the ANF were small compared to studies in other areas that have documented higher effects. Blackberry had the highest occurrence of ozone damage, with 40 to 60 percent of sampled plants showing symptoms of damage in 1998-2000, versus only 19 percent in 2001. Nearly 60 percent of black cherry plants sampled showed injury symptoms in 1998, but less than 16 percent showed symptoms between 1999 and 2001. However, even when these species show relatively high occurrences of ozone injury, the severity (percent of foliage on an individual plant showing signs of damage) has been low. Differences in the amount of ozone injury was more likely due to variation in precipitation levels (trees are less susceptible to damage during droughty conditions) than ambient ozone exposure levels (Morin *et al.* 2006). In conclusion, local monitoring indicates ozone has not substantially damaged woody vegetation on the ANF.

Site/species nutrient capability

Since the late 1970s, sugar maple across the northern tier of Pennsylvania has been suffering from a decline syndrome. Numerous factors have been thought to contribute to this decline, including droughts, late spring frosts, insect defoliations, disease organisms, forest management, atmospheric pollutants, and soil nutrient capability.

Recent local research conducted across the Northern tier of Pennsylvania and the Southern tier of New York indicates unglaciated upper slope sites and the plateau top are sensitive sites where sugar maple and other high base cation-demanding species (such as white ash and basswood) may be more vulnerable to stress events such as insect defoliation (Horsley *et al.* 1999, pp 60-62). These conditions are exacerbated by drought conditions. Research results indicate the most important factors associated with sugar maple health are foliar levels of magnesium (Mg) and manganese (Mn), and defoliation history. The lowest foliar Mg, highest foliar Mn, and highest number and severity of insect defoliations were associated with unglaciated summits, shoulders, and upper backslopes. Locally, sugar maple decline has been associated with two or more moderate to severe defoliations within a decade on sites with low levels of base cations, especially magnesium and calcium (Horsley *et al.* 2002). The decline disease of sugar maple seems to result from an interaction between low levels of Mg (and perhaps elevated Mn) nutrition, topographic position, and stress caused by defoliation or drought. The unbalanced Ca, Mg and Mn nutrition predisposes sugar maple to decline by reducing crown vigor, and excessive stress such as defoliation or drought incites (triggers) decline.

Within the ANF, where sugar maple occurs along plateau top and upper slopes, continued decline is expected. Sugar maple may not be sustainable on these sites. Sugar maple trees are less able to withstand stressors such as defoliations or droughts, due to these changes in soil nutrient status on the Allegheny Plateau. However, research has provided the following recommendations to maintain the health of sugar maple and other tree species (e.g. ash, basswood) with higher base cation requirements, which are incorporated in forestwide design criteria:

- Forest managers should consider proactive insect suppression activities when necessary to help reduce stressful conditions for sugar maple and other species with high base cation requirements (Horsley *et al.* unpublished 2005a).
- Choose appropriate sites to culture sugar maple. On upper slope and plateau top sites, landowners and managers should consider management activities that favor species with lower base cation requirements (Horsley *et al.* 1999, p 62; Horsley *et al.* 2000, pp 1365-1367; Horsley *pers. comm.* 2005). Recent local research results indicate that black cherry, American beech (subject to beech bark disease complex), white pine, chestnut oak, black birch, red pine, and red maple are examples of these species (Horsley *et al.* 2002, p 41; Long *et al.* 1997, pp 1563, 1564, and 1566; Long *et al.* 1999 pp 56 and 57; Demchik and Sharpe 1999). Their growth and health seems unaffected by lower local base cation availability on many sites. Mid and lower slopes on the unglaciated Allegheny Plateau are better suited to culture sugar maple, where it is present (Horsley *et al.* unpublished 2005a).
- Conserve base cations on sensitive upper slope and plateau top sites by retaining tops and branches on site to conserve Ca and Mg (Horsley *et al.* unpublished 2005a). Obtaining greater success in developing sugar maple seedlings and sustaining healthy sugar maple has been identified as an LRMP research need (see table 16 in the monitoring section of the LRMP).

Atmospheric deposition

For as long as the Pennsylvania Atmospheric Deposition Monitoring Network has maintained records (since 1982), the ANF region has received heavy inputs of sulfates and nitrates through wet deposition. In

New England, deposition with similar characteristics on soils poor in base cations has been associated with accelerated soil acidification (Likens *et al.* 1998), which is associated with leaching of base cations from the soil. Soils of the Allegheny Plateau landform are unglaciated and formed on a geological substrate with little calcium and magnesium. This makes soils on the ANF inherently susceptible to acidification and base cation nutrient leaching.

Recent local research compared archived soil (collected in 1967) from the Allegheny Plateau to soil collected 30 years later (Bailey *et al.* 2005). This comparison noted a statistically significant decrease in soil pH (increase in acidity), and calcium and magnesium soil nutrients. At the same time, a significant increase in available aluminum was noted. These findings indicate that changes in soil chemistry have occurred on the Allegheny Plateau in the past 30 years, consistent with changes that occur as a result of atmospheric deposition of sulfates and nitrates. Researchers were also able to establish soil nutrient thresholds necessary to sustain sugar maple heath (Bailey *et al.* 2004). In 1967, calcium and magnesium in Allegheny Plateau soils were above this threshold. In 1997, these soil nutrients were below the threshold. These results help explain sugar maple decline noted since the 1970s on the Allegheny Plateau.

See Section 3.2.4 (air resources) and section 3.2.2 (soils) for more discussion on atmospheric deposition. See forest composition and seedling regeneration composition of this affected environment for discussion of potential influences of acid deposition on tree seedling development and interfering vegetation.

Tree mortality/decline

Two major periods of tree mortality and decline have occurred since 1986: 1) substantial oak mortality developed in 1988, and 2) tree mortality and decline in Allegheny hardwood, northern hardwood and upland hardwood types developed rather suddenly in 1994 with lower amounts continuing to develop for several years thereafter.

Substantial amounts of oak mortality (10% to 80%) were confirmed in the fall of 1988 on about 18,000 acres of the ANF. This oak mortality resulted from the combined effects of two major natural events: repeated and extensive moderate or severe gypsy moth defoliation between 1986 and 1988, and a severe drought that occurred in the summer of 1988.

Insect and disease impacts in the early and mid-1990s created substantial stress on trees in the Allegheny hardwood, upland hardwood, and northern hardwood forest types, primarily affecting red and sugar maple, and beech. Evaluation of color infrared photos taken in mid-August 1994 showed that 89,565 acres of Management Area 3 had higher levels of tree mortality (29% of MA 3). Over half of it appeared to be moderate to severe. Additional mortality occurred between 1995 and 1999 though it expanded to include black cherry (which has suffered repeated cherry scallop shell moth defoliations).

In the more heavily impacted areas (~19,000 acres), stand data was collected in 1994 through 1996. Dead trees and trees at risk of dying account for 18.7 percent of the total basal area in this sample (McWilliams *et al.* 1996). Sparse tree seedling regeneration and the abundance of interfering vegetation in that survey raises serious concerns about tree seedling development and survival, as well as the long-term maintenance of forest cover on sites where tree mortality and decline are or may become most severe.

In many cases isolated or moderate infestation by forest pests or disease will not cause the death of a tree. However, when these stresses are combined with other factors that damage or reduce a tree's vigor, mortality may occur. Recent forest health monitoring completed across the ANF indicated that among the shade-tolerant species, 14.8 percent of the standing sugar maple basal area and 9.4 percent of the beech basal area are dead (Morin *et al.* 2006). Black cherry and red maple had the highest percent dead basal area in the 5-to10 inch class, probably due to self-thinning. This mortality would be expected to occur during self-thinning of a shade-intolerant species during the normal stand development process. American beech, conversely, had the highest proportion of standing dead basal area in the largest diameter class. This is from the beech bark disease complex, which tends to kill large trees (Morin *et al.* 2006). Among the five most abundant tree species on the ANF, dead trees are proportionally greatest for sugar maple (Morin *et al.* 2001, p. 59, Morin *et al.* 2006).

Forest health monitoring showed that from 1989 to 1998-2001, black cherry, red maple, American beech, eastern hemlock, and sweet birch increased in abundance while sugar maple, northern red oak, and white ash decreased in abundance on the ANF. Black cherry and red maple account for more than half of the total average basal area per acre on the ANF (Morin *et al.* 2006). This same forest health monitoring indicated the central two-thirds of the ANF had the most numerous defoliations and highest estimated standing dead basal area. Identifying integrated pest management activities to sustain healthy hemlock on the ANF in the face of HWA infestation has been identified as an LRMP research need (see table 16 in the monitoring section of the LRMP).

Looming forest health concerns

There are several threats to forest health on the ANF that are on the horizon. Exotic insects and diseases such as the hemlock woolly adelgid, emerald ash borer, Asian long-horn beetle, and sudden oak death have not been documented within the ANF. Their expansion to the ANF is likely, and their effects raise serious forest health concerns.

Hemlock woolly adelgid

Hemlock woolly adelgid (*Adelges tsugae*) (HWA) is a non-native insect that could substantially impact hemlock on the ANF within the next five to fifteen years. HWA was introduced into the U.S. from Asia in the 1920s, and it is spreading across the range of eastern and Carolina hemlock in the Eastern U.S. Both hemlock species are being killed and do not appear to have any resistance to the insect. HWA is considered to be the single greatest threat to the health and sustainability of hemlock as a forest resource in eastern North America (Knauer *et al.* 2002). Severe cold weather seems to slow the spread of this pest. Conversely, mild winter weather has resulted in rapid adelgid population growth and expansion the following seasons. Data suggests the adelgid is adapting quickly to colder temperatures as it spreads northward (McClure and Cheah 2002).

HWA has not yet been detected on the ANF, but has been detected in 44 counties in PA; one county is to the immediate southeast of the ANF. In September of 2005, HWA was detected in Elk County- the first detection in that County to date. This small insect feeds by sucking hemlock sap at the base of needles. A mature tree can be killed in 3-5 years, but mortality is usually a slow

process, occurring over a 2 to 12 year period or longer (Ward *et al.* 2004). Elongate hemlock scale (*Fiorinia externa Ferris*) is another introduced threat to hemlock trees that greatly hastens decline and mortality in mixed infestations with HWA. Other major factors that influence hemlock decline include stressors such as drought, poor site conditions, and insect and disease pests (Ward *et al.* 2004). Hemlock is an important forest component as thermal cover and habitat for many wildlife species, and its distribution along riparian areas is critical in maintaining appropriate water temperatures for aquatic species.

Several introduced predators of the adelgid, including Ladybird beetles (*Pseudoscytnus tsugae*), Coleoptera beetles (*Sasajiseymnus tsugae* and *Scymnus sinuanodulus*), and *Laricobius nigrinus* beetles, have been released in the State of Pennsylvania. Though predator release is considered to be an effective treatment to reduce established HWA populations, longer term establishment of these predators largely does not appear successful to date (PA DCNR, 2005). Chemical control can be used in easy access areas within or near developed recreation sites or high-quality scenic areas. However, this is very costly, and repeated treatments are needed to control the pest. Fungal controls are currently being researched, and may hold some promise to reduce HWA populations as part of an integrated pest management program (Costa *et al.* 2005).

Forest Health Protection has been monitoring for the HWA on the ANF since 2004, and none have been detected to date.

Emerald ash borer

Emerald ash borer (*Agrilus planipennis*) (EAB) native to western Asia, was discovered in 2002 feeding on ash trees in southeastern Michigan. Recent dendrochronological evidence indicates that the beetle was present for at least 10 years before discovery. Larvae feed in the cambium between the bark and wood, producing galleries (tunnels) that eventually girdle and kill branches and trees. At least 16 endemic ash species, as well as naturalized species and cultivars used in landscaping are at risk (Cappaert *et al.* 2005). Movement of firewood infested with EAB into uninfested areas increases the risk of spread for this insect. As of November 2006, populations were confirmed in Ohio, Indiana, Michigan, and Maryland (website accessed 12/6/06: http://www.emeraldashborer.info/files/TriState_EABpos.pdf). Detection surveys and eradication (chemical treatments, cutting, chipping and burning) efforts continue in those States. On the ANF, public education efforts and EAB detection surveys are ongoing. A firewood transport ban may be considered for the ANF at some point in the future.

Asian longhorned beetle

Asian longhorned beetle (*Anoplophora glabripennis*) is a serious pest in China and was discovered in 1996 on hardwood trees in Brooklyn, New York. Larvae feed in the cambium, sapwood and heartwood. Tunneling by the larvae girdles tree stems and branches and causes crown dieback and eventually tree death. In the U.S. it prefers maple species including but not limited to Norway, red, silver and sugar maple. Other known hosts are alders, birches, elms, horsechestnut, poplars, and willows (USDA FS 2004h). In 1998 populations were detected in New York (Long Island, Queens and Manhattan) and Illinois (Chicago). Beetles were also

detected in two separate areas of New Jersey in 2002 and 2004 and in California in 2005 (websites accessed 1/11/07: <http://www.aphis.usda.gov/ppq/ep/alb/chron-96-99.html> and <http://www.aphis.usda.gov/ppq/ep/alb/chron-2000-pres.html>). Detection surveys, quarantines and eradication (chemical treatments, cutting, chipping and burning) efforts continue in New York, Illinois, and New Jersey.

Sudden oak death

A phenomenon known as Sudden Oak Death (SOD) (*Phytophthora ramorum*) was first reported in 1995 in central coastal California. Since then, tens of thousands of oaks have been killed in California. Other host species include Rhododendron spp., huckleberry, and laurels. Movement of infected nursery stock has led to quarantines in PA and other states. SOD has been confirmed on nursery stock in 19 states, and was recently discovered on a mature tree in New York, which was subsequently destroyed. While monitoring for SOD will continue in the vicinity of the New York tree, SOD was not detected in the first year after treatment. Cankers form on the stems and once crown dieback begins, leaves turn from green to yellow to brown within a few weeks. The FH Monitoring program and its partners are conducting a national survey of forests at risk, focusing on forests of high and moderate risk. To date, with exception of the one tree already destroyed, no additional cases SOD in a forest setting have been detected in the eastern United States. In California a strategy of slow the spread is being adopted, and in Oregon an eradication strategy of felling and burning was carried out.

Forest vegetation management

Forest vegetation management is a tool used to achieve desired forest vegetation conditions on the landscape. These desired vegetation conditions include age and structural attributes (tree ages and sizes, canopy gaps, vegetative layers), forest composition (tree species), and healthy forested ecosystems. Most forest vegetation management applied on the ANF to date has been even-aged, with regeneration harvests creating young stands of a single age class within the broader maturing forest landscape. Even-aged treatments sustain a diversity of age classes, and provide horizontal structural differences across the landscape. Uneven-aged management has been applied on the ANF to a lesser extent, and overall with less success in obtaining sufficient tree seedling regeneration. Uneven-aged management sustains a greater degree of high forest canopy connectivity, and results in areas containing multiple age classes and trees from seedlings to large overstory trees, providing vertical structural diversity for wildlife. Reforestation treatments help achieve a number of land management objectives, ensuring healthy, diverse, well stocked forests are sustained on the landscape in the long term, particularly in conjunction with even-aged or uneven-aged regeneration methods.

Since 1962, forest vegetation on the ANF has been actively managed, using primarily a blend of intermediate and regeneration even-aged harvests. Initially, regeneration harvests consisted of clearcuts with few reforestation treatments applied. A survey of 65 regeneration harvests made in the early 1970s revealed that satisfactory natural regeneration was only developing in 54 percent of them. Subsequent studies have shown that the most important factor in successful natural regeneration on the ANF is the amount of advanced seedling regeneration present prior to the final overstory removal (Horsley *et al.* 1994).

In the mid 1970s, much greater emphasis was placed on ensuring advanced seedling regeneration existed prior to final overstory removal. In many cases a shelterwood seed cut was applied to develop advanced seedling regeneration prior to the final overstory removal. As more was learned about successful regeneration of hardwoods under high deer browsing impacts on the Allegheny Plateau, various reforestation activities were incorporated into silvicultural prescriptions. Fertilization and fence construction began on the ANF in the mid 1970s to ensure greater reforestation success under high deer browsing pressure. Herbicide application for reforestation purposes began on the ANF following completion of the 1986 Forest Plan. This was to remove interfering vegetation that exceeded levels that would permit establishment and development of desirable, diverse seedling regeneration as described by Horsley (1982). These reforestation activities have helped achieve a 96 percent success rate in establishing tree seedlings in scheduled even-aged final harvests satisfactorily (USDA FS 2004c, p. 27).

Table 3-24 displays the level of various silvicultural and reforestation activities by management area that have occurred since implementation of the 1986 Forest Plan. Most forest management activities on the ANF have occurred in MA 3.0, followed by MAs 6.1, 6.2, 2.0 and 1.0. A relatively minor amount of forest management has occurred in MAs 6.3 and 9.1 since implementation of the 1986 Forest Plan. A primary emphasis of vegetation management on the ANF in the past twenty years has been improving the age class distribution of forest vegetation and creating younger age classes, particularly in MA 3.0 where most even-aged final harvesting has occurred.

Table 3-24. 1986 forest plan harvest and reforestation activity accomplishments by management area (1986-2005)

Activity	MA 1.0	MA 2.0	MA 3.0	MA 6.1	MA 6.2	MA 6.3, 6.4 and 8.0	MA 9.1	Totals
Even-aged Intermediate Thinning								
Thinning (Acres)	170	31	45,053	3,156	3,022	0	445	51,877
Even-aged Regeneration								
Final Harvest with Residuals (Acres)	556	7	24,459	2,467	872	43	83	28,487
Shelterwood Seed (Acres)	97	0	17,265	1,193	797	0	33	19,385
Uneven-aged Regeneration								
Selection Cuts (Acres)	0	1,214	4,142	624	131	0	0	6,111
Reforestation Treatments								
Striped Maple Cutting	0	0	4,663	0	0	0	0	4,663
Site Preparation	117	110	20,757	1,582	567	16	84	23,233
Herbicide	54	550	17,828	619	384	0	112	19,547
Fertilization	205	0	14,168	558	345	41	0	15,317
Fencing	94	78	12,498	1,442	418	0	164	14,694
Planting/Seeding	114	17	1,768	496	0	0	177	2,572
Timber Stand Improvements								
Timber Stand Improvements	0	0	855	0	0	0	0	855
Release	20	17	4,539	508	98	0	130	5,312

Direct and indirect effects

Scope of analysis

The affected area for direct and indirect effects to forest vegetation consists of lands administered by the ANF. Direct and indirect effects will be assessed for the first, second and sixth decades of LRMP implementation to show how desired conditions relative to vegetation composition, age and stocking, and forest health would be provided over time as a result of proposed desired condition in each of the alternatives, associated management area allocations, silvicultural practices, treatment levels, investments, and outputs. This will be followed by a discussion of other cumulative effects on forest vegetation, such as development of privately owned mineral rights.

Introduction

This section introduces how changes to forest vegetation will be analyzed, what the key elements are, and how they will be tracked through the discussion. The key elements include:

- Forest Composition
- Forest Age and Stocking
- Forest health
- Forest Vegetation Management

The direct/indirect effect of, or the vegetation outcome from implementing an alternative is a result of the application of all management practices needed to meet desired vegetation conditions for that alternative. For example, the practices of even-aged and uneven-aged silviculture, road construction, reforestation treatments, recreation development and uses, and wildlife habitat improvement all have effects on the vegetation resource. Each alternative requires a unique mix of these practices to provide the alternative's response to the management problems or the issues. This is largely determined by the acreage allocated to each Management Area by alternative. Therefore, the effect of each alternative on ANF vegetation will be unique.

When assessing the direct/indirect effects of an alternative, consideration is given to the quantity of each practice, applicable standards and guidelines, where the practice would be applied, and over what time frame. All applicable standards and guidelines listed in the LRMP are incorporated into each alternative, and the effects evaluated accordingly. Standards and guidelines associated with vegetation management activities will help ensure a diverse, healthy and sustainable forest is provided for a variety of resources. All proposed vegetation management practices were evaluated in terms of the potential magnitude of their effects, which were integrated with the effects of other practices, to provide a comprehensive view of how a particular alternative would change the existing condition of each vegetation element.

Forest composition

Forestwide desired conditions in the LRMP include sustaining a diversity of vegetation species and forest types across the landscape in all alternatives. Forest composition generally refers to the presence and abundance of various tree species within forested areas. Forest composition can be influenced through activities that favor some species over others depending on the treatment, sequence and timing of

activities, and regeneration method, or through natural processes (absent management activities) that result in changes to forest composition over time. Species composition can be affected by the selection of which trees to cut versus those to leave in managed areas, or through not managing forested areas. Modifying overstory tree stocking or structure can influence tree species composition through altering environmental conditions on the forest floor. The amount of sunlight provided on the forest floor through overstory treatment influences the seedling species that are likely to become established. For instance, even-aged regeneration treatments favor shade-intolerant and intermediate species such as tulip poplar, black cherry, ash, aspen, red maple, and birch by providing abundant sunlight for seedling establishment and growth. Conversely uneven-aged silvicultural activities feature shade-tolerant species such as American beech, eastern hemlock, and sugar maple by maintaining more overstory canopy and shade. Activities such as road construction, oil and gas development, and stone borrow pit construction or expansion can also affect forest composition by converting forested areas to non-forest.

In conjunction with overstory manipulation, understory species composition can be influenced by reforestation treatments. This understory species composition, in turn, will eventually determine future overstory species composition. In order to ensure abundant and diverse seedling regeneration on the ANF, a number of conditions and intensive treatments are necessary, including:

- Insuring a diverse seed supply.
- Controlling deer browsing impacts through fencing and/or concentrating removal harvests within a small geographical area (creating abundant forage for deer).
- Providing adequate light to the forest floor.
- Removing low shade and interfering vegetation.
- Controlling forest floor disturbance.
- Waiting for seedling establishment, as many species take 5-20 years to become established.
- Releasing less common or unique tree species in order to better maintain seedling abundance and species diversity in regenerating areas.

Forest age and stocking

Forestwide desired conditions include sustaining a diversity of vegetative structural stages and age classes across the landscape, including a variety of healthy functioning vegetation layers and well distributed habitats for wildlife in all alternatives. Forest structure refers to the size, amount (density and numbers), and arrangement (from forest floor to tree canopies, and across landscapes) of forest vegetation. Forest structure is primarily affected through overstory silvicultural activities, though natural disturbances, tree decline and mortality also affect forest structure over time. Reforestation treatments primarily affect understory vegetative structure. Intermediate thinning treatments reduce tree density, changing the overstory structure. Even-aged regeneration treatments most notably change forest structure by regenerating mature areas of large trees to temporary openings stocked with seedlings and small trees.

Uneven-aged regeneration activities affect within stand structure, or vertical vegetative structure by promoting development of several age classes, while retaining the majority of the overstory tree canopy.

As mentioned previously, forest vegetation on the ANF is uniform and of very similar age. In order to better balance age class distribution on the ANF, some areas will be managed for young forest and early age classes (0-20 years old) through even-aged management, others will be managed to more quickly develop attributes of old structural stages, and others will not be actively managed at all. Forestwide objectives exist for creation of early structural stages.

Forest health

Forestwide desired conditions include providing resilient and diverse vegetative layers capable of sustaining well-stocked, healthy hardwood forests in the long term in all alternatives. Vegetation management can affect forest health through a variety of overstory and understory treatments. Not actively managing forests can also affect forest health. Reducing the density of trees enhances tree vigor and growth rates. Declining, mature, or poorly stocked stands can be regenerated to vigorous well-stocked stands through a combination of silvicultural and reforestation treatments. Invasive species that interfere with diverse forest understories becoming established can be controlled through reforestation treatments. Overstory treatments and timber harvest can influence the species composition of individual stands, where some species are more susceptible to current forest health concerns than others, as well as the age of forest vegetation (Waring and O'Hara 2005). As described by Waring and O'Hara, landscapes consisting of stands of similar sized and aged trees are more vulnerable to damage from a particular pest than if the landscape were composed of stands and forests of a variety of size and age classes.

Forest vegetation management

Vegetation management is a tool used to sustain desired forest composition, age class distribution, and health of vegetation found on the ANF. Each of the alternatives would provide for different types and intensities of forest vegetation management to meet desired conditions for forest vegetation. Intermediate treatments, even-aged and uneven-aged regeneration methods, and no active vegetation management all result in different forested settings, structures, composition, and wildlife habitat.

Effects common to all alternatives

The following discussion describes effects and influences on forest vegetation that are considered common to each of the alternatives, though the degree to which they would occur varies by alternative.

Integrated pest management practices

It is anticipated that existing forest health concerns present on the ANF, including the introduced beech bark disease complex, defoliations by both native and exotic insects such as the European gypsy moth, sugar maple decline, and the threat of hemlock woolly adelgid will persist. Though it is difficult to predict the degree of impact from these stressors, particularly the cyclical populations of defoliating insects, droughts, and introduced exotic forest pests, it is likely that some form of chemical (e.g. insecticides), biological (e.g. introduced predators that feed on exotic insects) and cultural (vegetation manipulation) treatments will be necessary. Treatments such as application of *Bacillus thuringiensis* would reduce

defoliations and subsequent tree mortality from various forest pests. Systemic treatments, such as the selective use of imidacloprid or other appropriate insecticide may be necessary to conserve individual hemlock trees infested with the hemlock woolly adelgid (Ward *et al.* 2004). Silviculture is an important part of an integrated pest management program, and can be a valuable tool in the prevention, mitigation, and restoration of forest ecosystems threatened by introduced forest pests that are responsible for reducing biodiversity, compromising ecological integrity, disrupting ecosystem dynamics, and displacing native species (Waring and O'Hara 2005).

The ANF will continue to work with Forest Health Protection to monitor forest health on the ANF, and develop strategies to reduce the impacts of stressors such as defoliating insects in all alternatives.

General effects of vegetation treatments

The following section defines the treatments presented under each alternative and their objectives, and describes some of the general effects of these silvicultural and reforestation treatments. The definitions or general effects of a particular treatment on a treated area do not vary by alternative. However, the magnitude of these treatments, and their cumulative effects on the landscape, are anticipated to vary by alternative. When silvicultural treatments are applied in stands that meet specified criteria, predictable results or outcomes can be achieved. Effects on vegetation will occur primarily from anticipated silvicultural treatments such as commercial timber harvest and reforestation treatments, non-commercial treatments, wildlife habitat improvement work, and from doing no treatment at all (allow natural processes to continue). These activities result in changes in understory and overstory conditions, forest structure, and changes in plant species composition and diversity, which in turn can affect forest sustainability and health. The specific effects of activities affecting forest vegetation will be evaluated at the project level.

The LRMP incorporates an adaptive approach to managing forest vegetation (see Appendix A to the LRMP). We anticipate changes to occur over time that will require adaptation in silvicultural techniques. Change associated with deer browsing impacts, insect infestations, invasion by exotic species or other environmental factors could require modification to one or more of the treatments described here. Annual monitoring and evaluation of treatments and effects, as well as the application of new silvicultural methods will be the basis for adjustments (see the monitoring section of the LRMP).

ANF vegetation management is implemented to accomplish multiple purposes. These will come from a variety of sources, including project level purpose and needs such as:

- Produce wood and other forest products
- Sustain, create, or modify wildlife and plant habitats
- Sustain or enhance quality riparian habitat and aquatic resources
- Help sustain long-term forest health
- Improve forest structural conditions
- Reduce probability of forest losses from wildfire or insects and diseases

- Control non-native invasive, or other undesired species of plants or animals
- Enhance scenery resources or provide desired forest recreation settings

Two silvicultural systems – even-aged and uneven-aged management – are proposed for use on the ANF. Reforestation treatments are used with either system. Standards and guidelines included in the LRMP to maintain snags, den trees, reserve areas and species diversity would apply to all vegetation treatments. See Appendix A to the LRMP for rationale for choice of vegetation management practices on the ANF.

Two general assumptions are made in the discussion of effects. First, it is assumed that deer populations will continue to be maintained at the lower levels achieved in recent years (see affected environment discussion on deer herbivory and interfering plants). If deer populations were to increase, or to be variable from year to year, efforts to establish seedlings and eventual stand regeneration success might be less than what is indicated here. Interfering vegetation already established on most of the ANF due to a legacy of deer browsing impacts (see affected environment) will still need treatment when the objective includes establishment of tree seedling regeneration. Second, it is assumed that when regeneration treatments are prescribed, the full complement of treatments needed to achieve regeneration success will be applied, and that additional reforestation treatments could occur if monitoring indicates the need.

Effects of harvest

Timber harvest activities occur in stands where silvicultural objectives are met through the removal of trees that have commercial value. The quantity and quality of trees to be removed is determined by the silvicultural treatment being applied in a given stand. Harvesting removes the main portion (bole) of the tree from the site. Trees removed in harvested areas vary in size from smaller pole-sized trees that are utilized for pulp or chipping, to larger sawtimber sized trees of high quality. The trees to be removed within individual harvest units are determined at the project level, and is guided by the silvicultural objectives for the harvest treatment. Tops of trees are left on the site, increasing the dead and down material component (small diameter) in the short run and increasing the number of low perches for wildlife. Since most of the nutrients in the trees are in the leaves, branches, stump and roots, leaving these portions of trees on site will help maintain nutrient cycling processes and soil fertility. Since some merchantable dying trees might be removed, there may be fewer snags on harvested sites than in stands that do not receive a harvest.

Salvage harvest

Salvage harvest recovers the economic value of dead and damaged trees, in response to tree mortality, tree decline, or tree damage from insects, disease or catastrophic events. Salvage harvest involves the removal of dead, dying, damaged, or high-risk trees that would die within the next 5 to 10 years. The direct effect of salvage harvest is primarily limited to those effects associated with the removal of woody material from the site. Effects to species composition, stand density and structure are the direct effect of the agent causing tree mortality and would occur whether or not the salvage harvest occurs.

Research (Marquis *et al.* 1992) suggests that when sites fall below 40 percent density in acceptable trees they should be considered for regeneration treatments because the overstory becomes too sparse and cannot fully utilize the site's resources such as water and nutrients. When the density of healthy trees in a stand is below 40 percent stand conditions are generally assessed to determine what kinds of reforestation treatments are needed to help regenerate the stand. Either even-aged or uneven-aged methods could be used, depending on management area direction and stand conditions. Remaining healthy trees are used to facilitate re-establishment of the new stand, through acting as a seed source and providing shelter for seedlings to become established. Healthy trees may be removed in subsequent harvest actions once adequate seedlings develop.

Even-aged management

Even-aged management results in the development of stands that are of similar age and mostly of size. Tree species that are shade intolerant (black cherry, white ash, yellow poplar) or mid-tolerant (red maple, birch, basswood and others) grow well under these conditions. Tree species that are shade tolerant (hemlock, beech, sugar maple and others) are often a minor component in stands managed as even-aged. Roach (1972) determined that clearcutting (and therefore shelterwood removal cutting) resulted in better stocking, a greater diversity of species, a higher proportion of intolerant species, and a faster growing new stand than any other method. This is largely influenced by deer browsing impacts on the ANF. Soil drainage, animal damage, and other environmental factors also influence which trees will eventually occupy the site. Site capability, particularly site nutrients, also plays a role in what trees are found on a specific site.

Though even-aged management results in stands with trees largely the same size, on the ANF, variation does exist in the size of trees the same age due to variations in the growth of individual tree species. This results in some vertical structure within even-aged stands on the ANF. Across larger landscapes, the application of even-aged silviculture creates horizontal (age class) diversity and spatial heterogeneity of forest ecosystems due to differences in vegetation age and sizes between stands. An even-aged forested landscape would contain a mosaic of seedling/sapling, poletimber, sawtimber, and old growth stands, scattered across the landscape. The mix of vegetative conditions found in a balanced even-age landscape provides for more diversity of wildlife habitats than the mix of conditions found across a landscape managed primarily as uneven-aged (DeGraaf 1987).

Clearcutting, shelterwood seed cut/removal cutting, and two-aged harvesting are all even-aged regeneration methods. The removal of the overstory trees results in a flush of understory vegetation and rapid growth and development of tree seedlings, shrubs and herbaceous understory vegetation. Mature trees are replaced by young seedlings, with corresponding changes in stand age. ANF monitoring data shows that reforestation success rates have ranged from 94 percent to 96 percent for areas treated with scheduled clearcut and shelterwood removal harvests between 1996 and 2001 (USDA FS 2004c). In nearly all cases, areas managed using even-aged silvicultural systems retain trees that serve as biological and structural legacies of the stand over the long term.

Shelterwood seed cut/removal cut with reserves

The shelterwood method is a multiple-step regeneration harvest where approximately one-third of the overstory is removed in the initial or shelterwood seed cut to encourage tree seedling development. The purpose of the shelterwood seed cut is to leave mid-sized, seed bearing tree, while removing enough trees to provide at least 50 percent sunlight on the forest floor for seedling development. Many of the trees removed will be pole-sized understory trees. These smaller trees, predominantly pulp material, are important to remove in order for adequate sunlight to reach the forest floor. Once adequate tree seedlings develop, usually in 3 to 15 years, but sometimes as late as 20 years, the second step called the shelterwood removal cut would occur. In the removal cut, nearly all of the overstory trees that were left as a seed source are removed, allowing full sunlight to reach established seedlings, resulting in rapid growth and development of tree seedlings, shrubs and herbaceous understory vegetation (Horsley *et al.* 1994, p. 223-224). Residual trees that include snags, den trees, conifer, mast species and uncommon species are retained following harvest. This treatment results in the development of primarily shade-intolerant tree species, with lesser amounts of mid-tolerant species, and some shade-tolerant species.

Clearcut with reserves

Clearcutting is used on sites where it is desirable to establish tree seedling regeneration, and results in the development of primarily shade-intolerant tree species. Clearcutting is a regeneration method used to establish even-aged stands whereby all trees except residuals (snags, den trees, conifer, mast species and uncommon species) are removed in one harvest. It is normally used where adequate tree seedlings are already present on the forest floor (Horsley *et al.* 1994, pp. 219 and 221), where established sapling or small pole regeneration exists, or in areas with high potential to develop new stems from stump sprouts, buried seed, or seeds produced on the site (Roach 1972). Removal of the overstory trees allows full sunlight to reach the forest floor, resulting in rapid growth of tree seedlings, shrubs and herbaceous vegetation (Horsley *et al.* 1994, p. 223-224).

Two-aged shelterwood seed cut/two-aged harvest

A two-aged shelterwood seed cut treatment, followed by a two-aged harvest, is used on sites where it is desirable to establish tree regeneration and there is an opportunity to increase the seedling component to achieve wildlife, riparian and/or age-class diversity objectives while maintaining two age classes on the site (Horsley *et al.* 1994, p. 223-224, Stout 1994, p. 360). This treatment has less visual change and maintains a more diverse vertical stand structure as compared to a more traditional even-aged final harvest (Miller *et al.* 1995).

Some uncertainty exists about the long-term results of two-aged management. Concerns exist about the feasibility of removing the second age class in 40 years due to the potential for these large-crowned trees to damage the small-crowned trees which would have been left as residuals. Research completed in areas that received a two-aged harvest twenty years ago indicates that residual overstory trees from original stand can have substantial influence over species

composition and growth of second age class (seedlings from original two-aged harvest). Miller *et al.* (2004) found that after 20 years, the crowns of the residual overstory trees had expanded by nearly 80 percent and collectively covered almost half of the stand area. They also noted significantly slower diameter and height growth for trees located under the canopy of residual overstory trees, and differences in the distribution of shade-intolerant and tolerant seedlings. With this treatment, regeneration of shade-intermediate and tolerant species such as red maple, beech, and birch is anticipated- particularly under residual overstory trees. Conditions for shade-intolerant regeneration such as yellow poplar, black cherry and ash would be maintained in the openings away from residual overstory trees, or less than half of the stand area. It may be necessary to gradually reduce the number of residual trees in order to maintain sufficient light levels for the new age class.

Intermediate thinning

Intermediate thinnings are designed to reduce stocking in highly stocked stands in order to enhance residual tree survival or to concentrate growth on the best trees, as well as harvest trees which are of poor quality or at risk of dying during the next 5 to 10 years. The harvest activity results in stands that are composed primarily of larger diameter trees with healthy crowns and adequate growing space, with many harvested trees coming from the smaller diameter classes (with a substantial pulp component).

Where deer populations are high, thinning may result in the development of fern understories and undesirable understory plants (Marquis 1994, p. 253), potentially resulting in the need for herbicide application in the future if regeneration harvests are considered. However, the understory vegetation found in most areas on the ANF is already dominated by fern, grass, beech and striped maple, therefore the potential for increased undesirable understory vegetation as a result of intermediate thinning is low (see affected environment, deer herbivory and interfering plan section).

Thinnings may also be used to help accelerate development of mature forest conditions in selected stands as described by Runkle (1991) and Singer and Lorimer (1997). This is an intermediate thinning that would remove approximately 20 percent of the trees overall, and be applied in a non-uniform manner to emulate the heterogeneity presently found in old growth forests as described by Franklin and VanPelt (2004). Some trees would receive complete crown release, while others would not be thinned around at all. This treatment would reduce canopy density to more rapidly develop larger diameter trees with enlarged crowns than would occur over time without intervention, as well as introduce more complex structure to the stand as the intensity of thinning will vary. It is designed to mimic small sized natural disturbances, where cutting would be a surrogate for competition-induced mortality.

Uneven-aged management

Within individual treated stands, uneven-aged management results in the development of trees that are of varying age and size class, with at least three age classes present. A number of partial harvests are applied in a stand managed under an uneven-aged system, and every regeneration

entry has the objective of establishing a new age class (Stout 1994, p. 333). In some cases an improvement cut might be applied in areas where seedling regeneration is not an objective, in order to improve stand quality and transition the structure towards that of an uneven-aged forest.

The 1986 Forest Plan provided what can be interpreted to be conflicting information concerning harvest activities on poorly drained soils (Group 3). Page 4-23 of the 1986 Forest Plan (USDA FS 1986b) stipulated that uneven-aged management should be used on poorly drained soils (Group 3) to prevent regeneration failures. Conversely, page 4-87 of the 1986 Forest Plan stated that uneven-aged management may be an option on inclusions in Management Area 3.0, such as riparian areas, wet soils, or visually sensitive areas, and that its use would be based on individual site analysis. Since implementation of the 1986 Forest Plan, uneven-aged regeneration methods have been much less successful in establishing adequate seedling regeneration than even-aged regeneration methods. Uneven-aged regeneration methods have only been 52 percent successful in establishing adequate seedling regeneration compared to 95 percent success rate for even-aged regeneration methods on all soil groups (USDA FS 2002, p. 23). A recent analysis (unpublished data analysis 2005) revealed that even-aged regeneration methods were 86 percent successful in establishing adequate seedling regeneration on poorly drained soils (Group 3), a greater success rate than that achieved through uneven-aged regeneration methods on all soils groups (52%) (USDA FS 2002 p. 23). Additionally, uneven-aged management, which would require entry to stands every 15 to 20 years, would likely result in additional compaction from harvest equipment, compounding concerns about soil compaction on poorly drained soils. Consequently, direction in the revised Forest Plan allows for the use of either even-aged or uneven-aged silvicultural systems on all soil groups, provided soil quality and function is maintained (see 2500 Watershed and Air goals, and Soil standards and Guidelines in LRMP). Additionally, the revised LRMP regulates use of heavy equipment on poorly drained soils (Group 3 soils). Areas that have received uneven-aged silvicultural treatments in the past will continue to be monitored, and future entries for uneven-aged management will follow revised standards and guidelines relative to uneven-aged management in the LRMP.

Uneven-aged stands are developed on the ANF through either single tree or group selection methods. Single tree selection in Alternative A (1986 Forest Plan direction) would result in openings up to one-quarter acre, and group selection openings up to one-half acre. Due to these small opening sizes, uneven-aged management in Alternative A, using either single tree or group selection would very strongly favor shade-tolerant species present on the ANF (sugar maple, beech, hemlock). These three species are presently subject to serious forest health concerns on the ANF. Additionally, with the exception of beech, limited success has been achieved in regenerating shade-tolerant sugar maple and hemlock on the ANF. Single tree selection in Alternatives B, Cm, and D results in openings of less than one half acre in the forest canopy, and also favors tree species that are shade tolerant (hemlock, sugar maple and American beech). Conversely, group selection in Alternatives B, Cm, and D would result in openings of one half to three acres, depending on the light requirements of trees comprising treated areas. This would allow for a greater range of tree species, including those more successfully regenerated in the past on the ANF and those moderately to less tolerant of shade (e.g. red maple, birches, oaks), to

become established. The larger group sizes proposed in Alternatives B, Cm, and D would better maintain tree species diversity, including a component of species that comprise many dominant forest types present on the ANF today that are not tolerant to intermediately tolerant of shade. Soil drainage, site nutrient capability, animal damage, and other environmental factors also influence which trees would eventually occupy the site.

Several concerns exist regarding the use of uneven-aged management on the ANF. Uneven-age management (particularly single tree selection) favors shade-tolerant species such as sugar maple (sensitive to site nutrients and subject to decline on nutrient poor sites), beech (subject to introduced beech bark disease complex), and eastern hemlock (subject to hemlock woolly adelgid). Serious questions remain on the effects of uneven-aged management on tree species composition, and subsequent forest health concerns, particularly under a single-tree selection system.

There has been limited success in the application of uneven-aged management on the ANF (USDA FS 1998 pp. 18 and 86; USDA FS 2001d pp.16, 17, 76, 77; USDA FS 2002 p.23; Stout 1994 pp. 333-334). Reforestation success with uneven-aged management (particularly single tree selection) has been very marginal on the ANF (37% adequately stocked with tree seedlings in 2001), whereas results with even-aged management have been quite good (96% adequately stocked with tree seedlings in 2001) (USDA FS 1998, pp. 17-18 and 86; Table 16 in reforestation program effectiveness subsection, USDA FS 2002, p.21-23). This limited success can be largely attributed to two factors: deer browsing impacts, and group opening sizes that were limited to less than one half acre under 1986 Forest Plan direction.

Considerable new information has emerged since the 1986 Forest Plan on the subject of uneven-aged silviculture. Perhaps the most relevant information is that reported by Nyland (2003) who synthesizes a great deal of silvicultural research to focus attention on the problem of practicing uneven-aged silviculture in even-aged stands. Most stands on the ANF are even-aged, resulting from turn of the 19th century cutting (Marquis 1975). So, most uneven-aged management practiced during the foreseeable future will involve treatments designed to make the transition from an even-aged condition to an uneven-aged condition (Stout 1994, p. 334). Nyland (2003) recommends a series of selection cuts where uneven-aged stand structures are consistent with management objectives, and suggests that effective conversion may take as long as a century. These cuts seem particularly important for the ANF, where research has shown that advance regeneration is key to successful reforestation (Grisez and Peace 1973). Further, Nyland recommends that where forest management objectives require retention of shade-intermediate and intolerant species, these conversion cuts should include creation of patches with diameters 2 or more times the height of adjacent trees (Nyland 2003). Dale and others (1995) found that numbers of trees per acre (both total and of intolerant trees) increased steadily as distance from the edge of openings increased through openings about 3 acres in size. They found that there was a detectable suppression of growth up to 100 feet into the openings.

Both single tree selection and group selection prescriptions can be used to achieve many landscape level objectives. Either single tree selection or group selection can also be applied in riparian areas or in areas where late structural characteristics are desired. These can be used to hasten stand development processes and initiate understory development, create gaps, multiple age classes, multi-layered canopies, irregular canopy cover, larger trees, down woody material, and vertical structure earlier than would occur naturally, as described by Nyland (*pers. comm.* 1998, 2004), Litvaitis (2003), Jenkins *et al.* (2004), Crow *et al.* (2002), Goerlich and Nyland, (2000), Franklin (2001), and Runkle (1985).

Area fencing will likely be required in most stands treated with uneven-aged management. Seedlings can be subjected to browsing by deer for longer periods of time as compared to those under even-aged management due to the slower development and growth that occurs in the understory (Stout 1994, p. 334). In recent years, browsing intensity has decreased on the ANF, but understory response lags behind the deer population drop (deCalesta 2005). Assuming deer populations remain low, improved success with uneven-aged management on the ANF is anticipated.

Uneven-aged management results in the development of greater vertical structure than even-aged management, and multiple age classes within treated stands. Uneven-aged management retains high forest canopy and does not create large blocks of early seedling-sapling stages. Horizontal diversity may develop within stands, however the diversity between stands (as would develop with the application of even-aged management) does not occur. If group selection is applied across larger landscapes, minor horizontal diversity would develop over time.

Group selection

Group selection is an uneven-aged regeneration technique that involves harvesting trees in small groups, as well as harvesting individual trees between the groups (Stout 1994, p. 333). Generally, entries occur every 15-20 years, however longer periods of time (perhaps as long as 40 years) between entries could also occur where older trees are desired. Alternative A would utilize group sizes up to one-half acre in all forest types. In Alternatives B, Cm, and D the size of group openings differs by forest type, with the intent of regenerating a diversity of tree species, including shade-intolerant (e.g. black cherry, yellow poplar, ash, northern red oak) and mid-tolerant (e.g. red maple, birch, cucumber) species. See Appendix A of the LRMP, Vegetation Management Practices – Rationale for Choice, for more detail. The following group opening sizes would occur in Alternatives B, Cm, or D under group selection:

- Upland hardwoods: 1 to 3 acres
- Northern Hardwoods: 0.5 to 2 acres
- Hemlock: 0.5 to 2 acres
- Allegheny hardwoods: 2 to 3 acres
- Oak hardwood: 1 (chestnut and white oaks) to 3 (northern red oaks) acres

Large patch sizes could have value in establishing a mosaic of age classes and maintaining greater species diversity at a landscape scale (Nyland 2003). Groups would occupy up to 15 percent to 20 percent of a stand to provide adequate sunlight conditions on the ground to enable the establishment, development and growth of a diversity of seedlings. Because a mature overstory would continue to predominate on most of the stand, group selection would provide habitat for primarily mid to late-structural wildlife species.

Most of the tree seedlings that will thrive within these groups will likely be of intermediate shade tolerance (Stout 1994, p. 334). Over the long term, red maple, birch, and other mid-tolerant species would dominate most openings, while some shade-intolerant species such as yellow poplar and black cherry would persist in the center of the larger openings. Shade tolerant species (hemlock, beech, sugar maple) would dominate the edges of the openings. The shade-intolerant and some shade mid-tolerant trees that develop in the shadier portion of the opening are expected to either die or be of poor form or quality. Over the long-term, this shift in species composition may substantially reduce the quality and value of future hardwood products in stands consisting primarily of shade-intolerant species where uneven-aged management is applied. Over extended periods of time, some forest type conversions would occur – with Allegheny hardwoods tending to shift to upland hardwood, and upland hardwoods tending to shift to northern hardwood.

Applying group selection as opposed to single tree selection has the added benefit of allowing seedlings to develop in concentrated groups without the reoccurring need to apply herbicide in the groups.

Single tree selection

Single tree selection is designed to remove individual trees, creating very small gaps in the canopy and favoring primarily establishment of tree seedlings tolerant of shade, eventually leading to a decline in species diversity because the light conditions favor relatively few species (Miller and Smith 1993, Miller and Kochenderfer 1998). Single tree selection cuts perpetuate shade tolerant tree species, such as hemlock, sugar maple, or American beech that generally are of lower commercial value (Stout 1994, p. 330). Stands receiving this treatment are expected to develop increasing amounts of American beech. Planned openings created generally do not exceed 0.5 acre. As shade-tolerant species generally have lower growth rates and lower commercial value, single-tree selection will lead to an eventual reduction in economic returns from commodity products as the proportion of shade-intolerant species declines (Miller and Kochenderfer 1998). When a series of such cuts are each successful, they promote development of a stand with many different age classes, i.e., an uneven-aged stand. Each selection cut, generally 15 to 20 years apart, is designed to create small temporary gaps in the forest canopy. The length of time between entries could be longer (perhaps as long as 40 years where specific structural objectives would benefit from longer time between entries). This increases the amount of sunlight that reaches the forest floor, causing seeds to germinate and stumps to sprout.

There is uncertainty related to the long-term use of single tree selection due to the anticipated need for herbicides in subsequent entries and the impact that herbicides would have on seedlings and saplings that develop slowly under partial shade of the selection system (Stout 1994, p. 334). There are also continued forest health concerns with the tree species (beech, sugar maple, hemlock) that would dominate areas managed under the single tree selection method.

The long-term effect of single tree selection is to create relatively little horizontal diversity between stands across the landscape. However, if deer browsing is controlled, vertical vegetative diversity within each stand is high. Deer browsing and interfering plants can have a dramatic effect on the success of uneven-aged silviculture. Appropriate reforestation practices must be prescribed to ensure reforestation success at every entry.

Effects of reforestation treatments

In a healthy, sustainable forest ecosystem, tree seedlings, herbaceous vegetation, and shrubs develop naturally whenever suitable light conditions are created on the forest floor. In both even-aged and uneven-aged management systems, the use of reforestation treatments to help stimulate the germination and growth of seedlings is commonplace. While there are several reasons why seedling development is difficult to achieve on the ANF, local research has provided management techniques that can be used for successful stand regeneration (Horsley *et al.* 1994, pp. 207-215; USDA FS 1995a, p. 26).

Silvicultural guidelines for hardwood regeneration on the Allegheny Plateau recommend that in areas with heavy deer browsing, abundant seedlings must be present before the final harvest (Horsley 1982; Bjorkbom and Walters 1986; Horsley *et al.* 1994, p. 220-223). Most of the reforestation treatments discussed here can be used in either even-aged or uneven-aged systems. In either case the purpose of the treatments is to promote the development of a diversity of desired tree seedlings, herbaceous vegetation, and shrubs. They are particularly important on sites where conditions favorable for seedling development are not found.

Initial identification of the need for reforestation and timber stand improvement treatments is based on existing or anticipated conditions within individual stands. Stands are monitored throughout the regeneration process to determine if seedlings are developing as planned and whether or not treatment modifications are needed to respond to changed conditions.

Herbicide application

Herbicide treatment is an important reforestation tool for both even-aged and uneven-aged management and has been used on the ANF since 1987. Interfering, invasive vegetation is present on most ANF understories due to a legacy of deer browsing impacts (see affected environment, deer herbivory and interfering plants section), and requires the use of herbicides as a site preparation technique in stands where establishing seedling regeneration is desired.

Herbicide treatments are proposed in stands that lack adequate numbers of tree seedlings and that contain a dense ground cover of grasses, fern, beech root suckers, striped maple, birch and other

woody vegetation (Horsley *et al.* 1994, p. 214-216, 231-238) that interferes with desired tree seedling establishment and growth.

Treatments would occur on sites where we are trying to establish new tree seedlings in order to perpetuate well-stocked forest cover, enhance vegetative structure, restore forest understory conditions, improve wildlife habitat, establish regeneration under an uneven-aged or two-aged system, or where final harvest activities are planned to establish young, even-aged stands. (Horsley *et al.* 1994, p. 215-216). It may also be used to prepare sites for planting, to create or maintain wildlife openings, create snags for wildlife, conserve heritage sites, create or maintain scenic vistas, maintain electric fences, and remove non-native invasive species. Sulfometuron methyl or glyphosate (or a combination of the two) is used during the latter part of the growing season (mid-July through mid-September) to control interfering vegetation where the objective is to sustain forest cover (Horsley *et al.* 1994 p. 232). A number of standards and guidelines listed in the LRMP help ensure safe and effective herbicide application.

Glyphosate is particularly effective in removing root-origin beech sprouts resulting from mortality of overstory beech trees, which are themselves susceptible to the beech bark disease complex, and are preventing other tree seedlings from becoming established (Horsley *et al.* 1994, p. 214-216, 231-238; Kochenderfer *et al.* 2001; Kochenderfer *et al.* 2004; Otfrosky and McCormack 1986). The beech bark disease complex results in significant beech mortality, with an understory response of increased beech root sprouting, and an increase in the amount of susceptible beech stems in affected areas, potentially leading to a second beech bark disease outbreak of more serious impact than the first (Otfrosky and McCormack 1986). A strategy to sustain resistant beech trees on the ANF includes removing trees that are susceptible to the disease complex, while retaining those that appear resistant to the disease complex as suggested by Burns and Houston (1987) and Mielke *et al.* (1986). Following a period of time for beech root sprouts to develop, foliar glyphosate treatments are applied to reduce the abundance of beech sprouts. This creates growing space for diverse tree seedling regeneration, including resistant beech sprouts and seedlings that will develop around resistant beech trees retained in harvest treatment areas. These resistant beech seedlings and sprouts can then develop with little competition from stems of susceptible beech trees. This is part of an LRMP research need (see table 16 in the monitoring section of the LRMP). Experience on the ANF in the use of foliar glyphosate treatments has not provided any evidence of translocation of glyphosate from treated understory foliage to other, larger beech trees.

The primary method of applying herbicide to date on the ANF has been through ground-based broadcast spray equipment. Some manual foliar application methods have also been used. Manual application methods can be more target specific, but are far less efficient in treating larger areas.

In addition to the ground-based broadcast and manual spray method of application, three cut surface treatments could occur – cut stump, cut and frill, and injection application methods. They are very target specific, and would utilize glyphosate herbicide to treat a variety of hardwood trees and other woody vegetation interfering with the establishment of desirable tree seedlings.

The cut-stump method is an alternative to treating numerous undesirable small beech stems, as only larger cut “parent” stumps would be selectively treated. This is because Glyphosate is readily translocated from the surfaces of freshly cut beech stumps via parent root systems (unlike foliar glyphosate treatments), to attached root-origin stems. These root-origin stems are clones of “parent” trees that are susceptible to beech bark disease. The targeted tree to remove would be cut and the stump treated with glyphosate (Kochenderfer *et al.* 2006). Tree injection or cut and frill methods involve the application of herbicide to standing trees through small incisions in the bark. These methods reduce damage to desirable residual trees and provide standing dead wood for wildlife. Kochenderfer *et al.* (2001) observed some damage to desirable trees of the same species being treated through injection of glyphosate, most likely from translocation of herbicide through root grafts. Forestwide standards and guidelines address this concern for both cut and frill, and injection methods.

Abundant tree seedlings, shrubs and forbs have the opportunity to develop beginning the first growing season after herbicide application (USDA FS 1991a, pp. 4-13 and 4-14). A wider range of plant communities could be expected to occupy the understory of treated areas (Horsley 1994, Ristau *et al. pers. comm.* 2005). Herbicide does not affect the viability of seed stored in the forest floor. Elimination of understory interference permits a larger variety of plants to occupy the area that are present at the time of treatment. Hardwood seedlings such as red maple, northern red oak, black cherry, yellow poplar, and birch are often found on the site the growing season following treatment. If deer browsing is low, eventually witch hazel, dogwood, elderberry, and hobblebush may become established in the treatment area, providing food, cover, and nesting sites for a variety of wildlife. Where deer browsing impacts are high, and fencing is used in conjunction with herbicide application, an even greater diversity of understory plants and tree seedlings would occupy the sites (Ristau *pers. comm.* 2005).

Recent research completed on the ANF found that herbicide application temporarily reduced the average number of species found, but after 3 years the numbers returned to pre-treatment levels, and after 5 years there was higher diversity and lower single species dominance in treated areas (Ristau *pers. comm.* 2005). The treatments rarely remove every individual of the dominant species.

Individual non-target plants within specific project sites may be injured or killed by herbicide application. The degree to which herbicides affect non-target plants varies by herbicide, time of year applied, and method of application. Glyphosate will kill most tree seedlings and shrubs which have green leaves at the time of spraying. Sulfometuron methyl will not harm, or may cause only slight damage to many of the tree seedlings present on the site if applied after September 1 (Horsley 1988, Horsley *et al.* 1992).

If adequate numbers of seedlings of sufficient size and desirable species that would achieve regeneration objectives are present in an area, herbicide treatment is unnecessary. However, some areas contain some or a diversity of seedlings to merit saving, but not enough to establish a new stand. Where tree seedlings are present in the understory and the competing vegetation is

primarily ferns or grass, spraying after September 1 with sulfometuron methyl would control the interfering vegetation without harming most of the tree seedlings. There is less impact on red maple, yellow poplar, white ash, and oak than on black cherry and some other species from sulfometuron methyl applied late in the season (Horsley 1988, Horsley *et al.* 1992).

There may be rare instances where respraying of an area would be necessary in a subsequent year. There would be no impacts on overstory vegetation from the additional herbicide application. For more information refer to the updated herbicide risk assessment (Appendix G1, p.G1-17).

Areas will be closely monitored through understory vegetation surveys to determine if herbicide application is necessary depending on interfering vegetation abundance and seedling stocking. Discussion of the potential effects of herbicide application on aquatic and terrestrial communities can be found in Chapter 4 of the ANF Understory Vegetation Management FEIS (USDA FS 1991a, pp. 4-1 to 4-18), in Appendix G2 of this document (updated risk assessments), and in the soils, hydrology, plant and animal communities, and human health sections of this document (Sections 3.2.2, 3.2.3, 3.3.2, and 3.4.8 respectively). In addition, the 1992 Understory Management EA appeal decision letter (USDA FS 1992c) provides a summary of effects to non-target organisms.

Wildlife species are mainly affected by habitat shifts, rather than from any direct affect of the spray mixture. The immediate effect of removing the dense ground vegetation layer will be temporarily decreased habitat for some wildlife species (e.g. voles) that utilize this shrub layer, while increasing habitat for other species (e.g. mice) (Stoleson *pers. comm.* 2005). As understory vegetation becomes established in treated areas, this habitat component will be re-established. Potential effects to wildlife from the herbicide application itself are evaluated in the updated wildlife risk assessment (see Appendix G2). More than a decade of herbicide treatments and monitoring on the ANF has shown that a diverse understory of woody and herbaceous species re-inhabit the site within two or three growing seasons (USDA FS 1998, pp. 21-24, 73-74; Ristau *pers. comm.* 2005).

Public concern over the health risks of herbicides continues. Appendix G displays updated risk assessments for human health and wildlife.

Herbicide application amounts proposed in various alternatives are the upper limit of what would be required to ensure the success of all treatments where establishment of seedlings and restoring understory conditions is an objective. The amount of herbicide application that would actually occur in each alternative is likely to be less than that proposed. The final decision to apply herbicide will be made by site specific project decisions, and will be based on actual vegetation and environmental conditions at that time within proposed treatment areas, along with site specific mitigation measures.

Fertilizer

This treatment is used to accelerate the growth of natural seedling regeneration and occurs primarily in the Allegheny hardwood type or where the great majority of seedlings are black cherry since other tree species do not respond to it as well (Auchmoody 1982; Horsley *et al.* 1994, p. 234-236). This treatment generally is used only after the final harvest cut is complete, and normally only on unfenced stands that are more susceptible to deer browsing. Use on plateau and upper sideslopes will be limited to minimize loss of soil base cations. Fertilization generally involves the aerial or ground application of nutrients on existing seedlings, usually during the month of May or June. The formulation used on the ANF contains 200 pounds of nitrogen and 43 pounds of phosphorous per acre (Auchmoody 1982; Horsley *et al.* 1994, p. 236). The immediate result is growth of a dense thicket of tree seedlings, primarily black cherry, that are tall enough to escape being browsed by deer. These seedlings naturally thin themselves, though some may also require a release treatment (see below) to help maintain tree species diversity on the site.

New information, however, suggests a risk that addition of nitrogen based fertilizers on plateau, upslope and shoulder sites on the ANF can exacerbate loss of soil nutrients (Bailey *et al.* 2005, Hutchinson *et al.* 1998). Recent research conducted on the unglaciated Allegheny Plateau indicate that changes in soil chemistry have occurred on the Allegheny Plateau in the past 30 years, consistent with changes that occur as a result of atmospheric deposition of sulfates and nitrates (Bailey *et al.* 2005). In accord with the results of Hutchinson *et al.* (1998), we assume that nitrogen applied in fertilizer has similar effects on soil nutrient status as nitrogen added from atmospheric deposition. Following fertilization, the nitrogen in the applied fertilizer acidifies soil resulting in displacement of base cations (e.g. calcium and magnesium). As the wave of displacement moves down through the soil profile, base cations move out of the rooting zone and making nutrients unavailable to trees. In the short term, this is a particular problem for species that either have a requirement for these base cations, or are responsive to them (e.g. sugar maple, basswood and white ash). Consequently, new guidelines exist in the LRMP to limit application of nitrogen-based fertilizer, particularly on plateau, shoulder, and upper backslope landforms.

Area fencing or individual tree fencing

Area fencing is used in locations where deer browsing impacts are high to exclude deer from a site and reduce the amount of browsing that occurs on desirable vegetation. Fenced areas develop taller seedling regeneration and higher seedling stocking with more desirable species where adequate light exists, as opposed to unfenced areas (Bjorkbom and Walters, 1986). A dense layer of seedlings, shrubs, and herbaceous vegetation has been shown to develop inside fenced areas if adequate light exists and there are few interfering plants. Experience on the ANF shows that where a variety of tree species exist, area fencing can also greatly increase herbaceous and woody plant species diversity and abundance, as well as improve future stand structure (Horsley *et al.* 1994, pp. 236-238). Many areas managed under uneven-aged systems, or treatments designed to restore forest understories will need to be fenced for very long time periods, resulting in some large investments to achieve structural objectives. Fencing can also result in additional birch and pin cherry seedlings that rapidly overtop other tree species (Horsley *et al.* unpublished 1998),

sometimes resulting in the need for release in order to ensure a diversity of species dominate the future stand. Fencing has limitations in its practicality when roads or other travel corridors bisect areas in the process of regeneration. Fencing is an important treatment in both even-aged and uneven-aged management.

In some tree or shrub planting areas, small woven-wire fences around clumps of planted stock (cribs) or protective plastic tree shelters are used to provide planted tree seedlings protection from deer browsing.

Site preparation for natural regeneration and site preparation/striped maple cutting

This treatment is proposed to remove stems that would interfere with the development of a diversity of seedlings. It involves the cutting of mid-story beech, striped maple, birch, red maple, or other selected woody species in order to reduce shading and promote development of tree seedlings. These small trees are usually 5 to 30 feet tall. Sometimes site preparation occurs after the shelterwood removal or clearcut to reduce levels of interfering woody vegetation.

Full and supplemental planting

Tree seedlings are planted to help achieve several objectives: 1) to help establish tree seedlings in an area where natural regeneration has failed or is not attainable, 2) to help bring about a conversion of forest types (though this does not often occur on the ANF), and 3) to help achieve tree species diversity objectives in regenerating stands. Planting will increase the number and abundance of tree species on individual sites. Regionally, there will be no increase in the number of tree species because no new species will be introduced. Since planted stock is generally less than two feet in height, short-term benefits are limited to improvement in stocking and species diversity, and certification of stands as successfully re-established. However, over the long-term (>20 years), these treatments are expected to improve stand stocking, structure, and composition, as well as help to meet wildlife objectives through improved cover/forage and/or mast conditions in the treated stands.

Mechanical scarification

Soil scarification is a site preparation technique designed to expose bare mineral soil to enhance the regeneration and establishment of tree seedlings, generally oaks or sometimes conifers. This treatment involves traversing the site with a small machine that rakes or otherwise disturbs the forest floor. The objective is to mix the forest floor and mineral soil surface, thereby increasing seed and mineral soil contact. In oak stands, this treatment also lightly buries acorns in the surface soils.

Scarification has been shown to increase germination and survival of various oak species because the acorns are hidden from predators, have optimal soil conditions upon germination, and reduced desiccation. Measurements the growing season after scarification indicated that oak responded to the treatment with three to 12 times the number of seedlings when compared to control areas (Zaczek *et al.* 1997; Lhotka and Zaczek 2003).

Prescribed burning

Timely surface fires have been shown to increase oak seedlings and sprout densities. This gives the species the competitive advantage needed to ensure an oak component in the next stand (Brose *et al.* 1999a; Brose *et al.* 1999b). Prescribed fires would be used when species that interfere with oak regeneration such as birch, striped maple, and red maple are most susceptible to killing, and oak is not. The fires would generally be characterized as moderate to high intensity surface fires that consume the upper portions of the leaf litter. This treatment would occur several years after the shelterwood seed cut when the oak seedlings have had enough time to develop their root systems so they will rapidly resprout following fire. Larger oak seedlings/saplings are quite resistant to fire; the rootstocks are capable of sprouting numerous times (Brose *et al.*, 1999b). Other species such as maples, beech, and birches are not tolerant of fire, and are not capable of sprouting as vigorously as oak species. Multiple burns over a 10 year period may be necessary to build the competitive advantage needed for oak seedlings to reach the main canopy.

Prescribed burning may also occur to prepare seedbeds for white pine or hemlock regeneration, though on a limited basis.

Timber stand improvement

Release

Release treatment involves the non-commercial, manual cutting of tall-growing woody vegetation (generally of seedling or sapling size) that interferes with the growth and survival of tree seedlings, saplings, or shrubs (either naturally occurring or planted) desired in areas generally 5- to 20-years old. Release can promote growth and survival of species not common on the site (such as aspen, oak, ash and cucumber) which are at risk of being killed by species that out-grow them, potentially increasing species richness on the site. Release is expected to improve tree species composition in the long term (USDA FS 1998, pp. 26 and 79; Marquis 1994b, pp. 269 and 282).

Precommercial thinning

Precommercial thinning fells trees in a stand that is not old enough for a commercial treatment. Trees are left on site where they are felled. The objectives of the treatment are to control species composition, maintain stand diversity, improve stand quality, to improve mast production, to improve wildlife habitat, and to increase growth rates on the preferred trees. The optimum stand age for completing this treatment is 20 to 30 years.

Noncommercial thinning

Noncommercial thinning is implemented to complete the silvicultural prescription where the optional pulpwood is not cut in the commercial timber sale, or to thin stands that are inaccessible or low in commercial value, in order to meet a variety of resource objectives. Felling trees helps control species composition, stand quality, and improves growth rates on the preferred trees. Trees are generally left on site and increase small woody debris on the forest floor.

Creation of permanent openings

In these treatments, most of the woody vegetation would be removed, and the site seeded to native warm or cool season grasses for wildlife. These treatments would convert currently forested areas to permanent wildlife openings. In some cases herbicide application may be used to remove undesirable vegetation so higher quality herbaceous vegetation for wildlife can be seeded or planted.

Effects on forest vegetation where no active management would occur

Similar to areas that are actively managed, areas where no active management would occur are also anticipated to result in changes to forest structure, composition, and forest health. In general, forest types that are considered part of the northern hardwood group (Allegheny, upland and northern hardwoods), are anticipated to slowly transition towards tree species tolerant of shade, such as beech, hemlock, and sugar maple. In the long term, this has implications for forest health, as all of these species are presently subject to serious forest health concerns. In unmanaged portions of the ANF where oak types dominate, a slow transition towards red maple and other hardwoods is anticipated over the long term. This has been identified as an LRMP monitoring item (see Table 16 in the LRMP).

As discussed previously, some management areas on the ANF permit forest vegetation management, where others will not. Management areas 5.1, 5.2 (designated Wilderness and wilderness study areas), 6.3 (Buzzard Swamp), 7.1, 7.2 (developed and remote recreation areas), 7.3 (interpretive recreation area), 8.1 (wild and scenic river corridor), 8.2 (National Recreation Area), 8.3 (Scenic area), 8.5 (Research Natural Area), and 9.1 (managed with minimal investment; Alternative A only) emphasize other values and generally do not permit scheduled vegetation management. For all alternatives, in areas where no vegetation management would occur, changes in the character of vegetation will generally be the result of natural stand development processes, along with the effects of native and non-native invasive insects, diseases, and vegetation, rather than management activities. Age class distribution would remain the same in the short term. Changes currently taking place due to tree maturity or decline will continue. The rate of change will be set by the interaction of natural forces such as additional drought, native insect defoliations or diseases, windstorms, or human caused forces such as introduced insects and diseases or atmospheric deposition.

The following discussion applies to all alternatives, as each of the alternatives would result in some proportion of the ANF allocated to management areas where scheduled forest vegetation management would not be permitted, though the amount varies by alternative. Alternative A would result in the least amount (8%) of the ANF allocated to areas where active management is not permitted, followed by Alternative B (22%), and Alternative Cm (26%). Alternative D would allocate the largest proportion (31%) of the ANF to areas where scheduled vegetation management would not occur. In these areas, this limits our ability to provide a diversity of age and structural classes, influence species composition, and proactively respond to forest health threats. The LRMP provides direction on the suitability of different management areas to be salvaged and associated reforestation activities applied (see Suitable Uses and Activities section of LRMP), including management areas that are not considered part of the suited land area for scheduled timber harvest. Of the area considered unsuited for scheduled forest vegetation management, Alternative A would allow 13 percent, Alternative B 70 percent, Alternative Cm 66 percent,

and Alternative D 70 percent to be salvaged and treatments applied to reforest them. Salvage and reforestation treatments would occur to sustain forest health, respond to natural catastrophes, restore forest cover, or to achieve recreation or wildlife objectives.

Herbivory (deer browsing impacts)

On the Allegheny Plateau, extensive and selective deer browsing has impeded the growth of seedlings and saplings, impacting natural regeneration and reforestation following natural or anthropogenic disturbances since the 1920s (Whitney 1984, Tilghman 1989, Jones *et al.* 1993, deCalesta 1994, Redding 1995, deCalesta 1998, Horsley *et al.* 2003). Browsing has greatly decreased the number of seedlings that are preferred as browse on the ANF, such as oaks, maples, cucumbertree, yellow poplar, hemlock, white pine, and birches. At the same time, species they prefer less, such as beech seedlings and suckers (which are susceptible to beech bark disease complex mortality), striped maple, fern and grass have increased in abundance. These species interfere with the establishment and survival of a diversity of seedlings on the ANF (Horsley *et al.* 2003). This raises concerns over the future sustainability of fully stocked, diverse forested ecosystems on the ANF where the LRMP permits little human intervention to control forest and ground vegetation structure, composition, and development.

In areas where no vegetation management will occur, no new 0-10 age class would be created, resulting in a low deer carrying capacity and continued deer browsing impacts on understory vegetation. In these areas, a loss of biological diversity in plant species over the long term (>50 years) is expected (Tilghman 1989, Jones *et al.* 1993, deCalesta 1994, Horsley *et al.* 2003) due to anticipated increases in deer browsing impacts. At the same time, interfering vegetation would continue to limit seedling development.

In recent years, browsing intensity has decreased on the ANF, but interfering understories are already well established on most of the ANF as a result of past deer browsing, and lag in their response to recent reductions in deer herds (deCalesta 2005). With continued use of the Pennsylvania Game Commission's Deer Management Assistance Program, improvements in understory health and diversity may become evident with time, however, to what degree is uncertain.

Canopy gaps and interfering plants

Over time, individual declining tops and dying trees would permit more sunlight to reach the forest floor through gaps in the canopy, encouraging expansion and growth of understory vegetation. Shade-tolerant seedlings that do develop would often be browsed and eaten by deer. Consequently, the understory vegetation would likely consist of grass, fern, beech, and striped maple in these areas. Trees that die will most likely not be replaced by similar species or, in many cases, by any species of vigorously growing tree seedlings that are capable of growing to replace them. Beech (subject to beech bark disease), striped maple (short-lived understory tree) and birches (subject to nectria fungus, often resulting in mechanical stem failure by age 60) can grow into the midstory and contribute toward vertical diversity and habitat structure. These are most likely the species that will provide vertical diversity in the long term.

Tree seedling establishment and growth

Fern and grass vegetation will persist unless it becomes shaded by woody vegetation such as beech, striped maple, or sweet birch. Where present, this interfering woody vegetation would similarly control light as low shade, which would prevent many seeds from germinating or prevent most seedling species from becoming established. In addition, this vegetation will aggressively occupy the site. That makes conditions difficult for new seedlings to compete for moisture and soil nutrients.

Forest health monitoring data collected in 1998-2001 indicates adequate tree seedlings are present on only slightly over 9 percent of the ANF, though forest health monitoring protocol only counts seedlings >12 inches tall (Morin *et al.* 2006) (

Table 3-22).

American beech

Recent forest health monitoring data found American beech (subject to beech bark disease) to be more than twice as abundant as any species in both the seedling and sapling classes, with nearly as many stems/acre in each size class as all other species combined (Morin *et al.* 2006). It is likely American beech will dominate understory vegetation in many areas where no vegetation management would occur.

Recent surveys completed in portions of the ANF where the BBD was first detected indicated a 66 percent loss, due to mortality, of beech basal area greater than 6-inch diameter between 1991 and 2003 (MacKenzie, unpublished 2005a). In New England where beech bark disease complex has been present and killing American beech for over 50 years, on the average half of the trees die, and only 1 percent of the trees appear immune to the complex (Houston 2005), though some will demonstrate partial resistance.

Within gaps created by dead beech trees, beech thickets formed by prolific root sprouting can pose significant competition to other seedlings (Forrester *et al.* 2003; Hane 2003, Latty *et al.* 2003). Forrester *et al.* (2003) concluded that the slow death of canopy trees caused by beech bark disease complex and lack of soil disturbance does not appear to offer recruitment opportunities to shade intolerant and mid-tolerant species. Long-term data from the Hubbard Brook Experimental Forest has found that advanced beech regeneration has radically impacted the understory structure of the forest, and given high densities of beech saplings and low densities of sugar maple, beech is likely to take over many of the new gaps that are created (Hane 2003).

As beech scale complex continues to spread within the ANF, individual beech and northern hardwood stands with concentrated pockets of beech will be affected by mortality of larger beech trees and subsequent root-sprout origin beech regeneration. As almost all beech seedlings are of root sprout origin, those that do develop into saplings and small poles are clones of susceptible parent trees and will also be affected by beech bark disease complex. The effects of beech bark disease prevent beech trees from growing to maturity and often results in early death.

Additionally, the lack of mature trees and stress from the disease complex severely affects mast production. The disease complex spreads and persists more strongly where the density of the beech population increases, as would be the case where no vegetation management would occur. In the long-term, unmanaged areas with a substantial beech component affected by the disease complex would develop into an "aftermath forest", with slow-growing trees of low value and volume (Mielke *et al.* 1986).

Birch

Sweet birch can withstand moderate to high deer pressure when it becomes established in quantity, and has been increasing in abundance in recent years on the ANF as deer browsing impacts have declined in some areas. Sweet birch is of intermediate shade tolerance and grows rapidly in partial or full sunlight. As birch matures and grows to sawtimber size on the ANF, it is often affected by *nectria* fungus and develops cankers in the main stem. The canker usually substantially reduces the commercial value of the trees and often results in mechanical failure (breakage) of the stem. Few birch trees on the ANF exceed 60 years of age (Morin *et al.* 2006).

Striped maple

Striped maple is a relatively small and short-lived tree species. It persists well in shaded conditions and multiplies effectively. If released to full sunlight, it grows rapidly and aggressively for about 30 years. At this point it becomes susceptible to wind or ice damage. Many of these trees die due to mechanical failure (breakage) of their roots or stems. In this case the tree often re-sprouts prolifically from the root or stump and repeats the cycle.

Summary of long-term understory and overstory change

Beech, striped maple and birch are the species that would likely dominate the understory, midstory, and, eventually, the overstory of much of the unmanaged forest. A general shift towards mixed upland and northern hardwoods is anticipated in many areas on the ANF over the long-term in areas that will not be actively managed. The relative mix of species present in these future upland hardwoods will shift, however, with a far greater proportion of birch species anticipated (which tend to only live 60 years on the ANF) than that present in mature upland hardwoods today. In areas with a large beech component, the future northern hardwoods are projected to have a much higher proportion of beech stems, which are subject to the beech bark disease complex, than that present in these northern hardwood stands today. Over the long-term, it is possible that the seed-producing overstory would decline to the point where inadequate amounts of seed will be produced for successful, diverse natural regeneration. At the same time, interfering vegetation would create poor seed germination conditions or would prevent seedlings from becoming established, while continued deer browsing impacts would result in browsing of what seedlings do manage to become established. When left alone, this form of vegetative succession tends to occur in patches rather than evenly across the landscape. That is, dense patches of fern, with a sparse overstory or no overstory, tend to appear within dense patches of striped maple, beech, or sweet birch. Open canopy areas would have a mixture of open grass and fern patches, dense mixed or monoculture sapling stands of blocks of striped maple, beech, or

sweet birch. In summary, most forested areas on the ANF will transition towards northern or upland hardwoods or grass and fern or sapling dominated savannahs where active management does not occur.

Oak ecosystems

Oak ecosystems on the ANF, are likely to transition to other hardwood species such as red maple in the absence of active management. It is believed that the occurrence of oak forests in the major drainages (Allegheny River, Clarion River, Tionesta Creek and others) is related to Native Americans use of fire (Ruffner *et al.* 1997, Ruffner and Abrams 2002, Black *et al.* 2006). Prior to European settlement of the area, Native American Indians set frequent to periodic low-intensity fires (11 to 26 year frequency) (Ruffner *et al.* 1997, Ruffner and Abrams 2002) that helped maintain the oak forest types present on the ANF today. Evidence suggests that this process of fire and oak recruitment occurred for hundreds and thousands of years, but was broken during the early 20th century following extensive settlement by Europeans (Abrams 2005).

Current fire frequencies in the ANF are much lower than those during the pre-settlement period. Oak recruitment has nearly ceased in the past 50-100 years in much of the eastern U.S., and the lack of fire has allowed many other hardwoods, like red maple, to increase in numbers and size, dominating oak forest understories and creating dense shade on the forest floor (Abrams 2005). Consistent with Abrams' observations, recent forest health monitoring in oak types on the ANF found red maple to be the most abundant seedling species, followed closely by American beech (Morin *et al.* 2006). This virtual absence of oak regeneration indicates that oak-dominated stands will likely transition to stands dominated by other species in areas where forest management is not permitted.

Alternative D allocates the largest proportion (63%) of oak types on the ANF to management areas that exclude active management of forest vegetation, while Alternative A allocates the least amount (23%) of oak forest types on the ANF to management areas that exclude active vegetation management. Since the presence of oak is associated with overstory disturbance and understory fire (Brose *et al.* 1999b) to develop adequate advanced oak seedling regeneration that is competitive with other species (Miller *et al.* 2002, Brose *et al.* 1999a, 1999b), Alternative D poses the greatest risk to sustaining oak types on the ANF. Alternative Cm allocates that second largest proportion of oak types on the ANF to management areas that exclude active vegetation management. Most of the oak types that would not be managed in any of the alternatives occurs in areas where dispersed recreation values are emphasized, such as designated Wilderness and Wilderness Study Areas, Wild and Scenic River corridors, remote recreation areas, and National Recreation Areas. However, of the oak types considered unsuited for scheduled forest vegetation management, Alternative A would allow 93 percent, Alternative B 96 percent, Alternative Cm 89 percent, and Alternative D 64 percent to have treatments applied to sustain forest health, respond to natural catastrophes, restore forest cover, or to achieve recreation or wildlife objectives.

Other influences

Change will vary depending on current and future stress levels in the trees in each stand, the amount of stocking and natural disturbances. Future stress events such as drought or insect defoliation may combine to result in future mortality and decline in unmanaged portions of the ANF where no action would occur to direct forest vegetation composition, structure, and development. Other influences on forest vegetation will continue to varying degrees, across all alternatives. These include the effects of beech bark disease, atmospheric deposition (acid rain), threats to forest health, and oil and gas development activities that fragment forested areas (see cumulative effects discussion).

Effects from each alternative

The following four key elements will be used to order the presentation of potential effects to forest vegetation under each alternative. The intensity and type of forest vegetation management can influence the other three elements.

- Forest Composition
- Forest Age and Stocking
- Forest health
- Forest Vegetation Management

These elements provide a valuable comparison of effects on ANF forest vegetation, or the outcomes, from the combined vegetation management treatments within each alternative. They provide important indications of the condition of the forest vegetation on the ANF over the short-term (next twenty years), as it relates to the issues or concerns identified for plan revision. These short-term changes also can be used to help project what may happen over the long-term (next 50 to 100 years).

Projections of silvicultural and reforestation activities, and forest composition (forest types) and structure (age class distribution) displayed in both direct/indirect and cumulative effects discussions were calculated by the SPECTRUM, model, using a combination of current conditions, predicted treatments, and management constraints. Appendix B of this FEIS provides more information on vegetation modeling using the SPECTRUM model.

Alternative A of the LRMP is a continuation of the management direction contained in the 1986 Forest Plan. The desired condition for Alternative A is to sustain a mix of predominantly younger (0-20 years) and intermediate (21-140 years) forests, primarily through even-aged management in MAs 1.0 and 3.0. Older forest is sustained in largely disconnected patches across the ANF. Alternative A emphasizes sustaining Allegheny and oak hardwood types.

Alternative B, similar to Alternative A, has a desired condition of sustaining younger (0-20 years old) and intermediate (21-140 years) forest, primarily through even-aged management in MAs 1.0 and 3.0. Alternative B also emphasizes Allegheny and oak hardwood types, but late structural conditions would be provided in a connected manner across the landscape, portions of which would be actively managed to accelerate restoration of

late structural attributes, as well as provide an early structural component consistent with historic disturbance regimes on the Allegheny Plateau.

The desired condition for Alternative Cm is to sustain a mix of younger (0-20 years), intermediate (21-140 years), and older (>140 years) forests in all forest types. Younger and intermediate forests would primarily be sustained through even-aged management in MAs 1.0 and 3.0. Older forest would be provided in a connected manner across the landscape, portions of which would be actively managed to accelerate restoration of late structural attributes, as well as provide an early structural component consistent with historic disturbance regimes on the Allegheny Plateau.

The desired condition for Alternative D is to sustain primarily intermediate (21-140 years) and older (>140 years) forest conditions primarily in upland and northern hardwood types. Younger (0-20 years) forests would be sustained on 2-4 percent of the ANF landscape as a whole, consistent with historical disturbance regimes for the area (see discussion under Affected Environment of vegetation, natural disturbance section). Younger forest would be sustained primarily through even-aged management in MAs 1.0 and 3.0, with smaller components sustained in MAs 2.2 and 6.1.

Alternatives A and B emphasize harvest of Allegheny and upland hardwood types in early decades, and other forest types in later decades. Alternative Cm emphasizes a mix of forest management in all forest types to provide both young and older forest ages, and includes greater silvicultural activity in northern hardwoods and poorly stocked stands. Alternative D emphasizes the application of uneven-aged and passive (no) management to sustain predominantly mid and late structural upland and northern hardwood forests on much of the ANF, primarily in later decades of the planning period. Uneven-aged management in portions of MA 2.2 in Alternatives B, Cm, and D would be applied to accelerate development and restoration of diverse forest understories and late structural vegetation conditions, along with even-aged management to sustain an early structural component. Other portions of MA 2.2 would be passively managed in all of these alternatives. The amount of land area available for active silvicultural treatments in MA 2.2 may change over time as newly constructed roads for private oil and gas could be added to the Forest Service system in the future. Uneven-aged timber harvest scheduling emphasizes repeated harvest entries in MAs 2.1 and 2.2. Shade intolerant and intermediate forest types such as Allegheny, upland, oak, and aspen hardwood forest types would primarily be maintained through even-aged management in MAs 1.0 and 3.0, and to a lesser extent in MAs 6.1 and 2.2. The amount of land area allocated to each Management Area and predominant silvicultural system (including no active forest vegetation management) varies by alternative.

Forest composition

For the purpose of this analysis, forest types will be used to discuss species composition, diversity, potential effects of NNIS, and maintenance or restoration of forest health. The amount of each forest type under each alternative will be compared to the existing condition and may change by alternative depending on the amount and types of activity allowed under each Management Prescription. The desired condition relative to forest composition in Alternatives A, B, and Cm is that dominant forest types on the ANF continue to be upland and Allegheny hardwoods. northern hardwoods are sustained, though to a somewhat lesser extent. Oak is maintained primarily in older forests and regenerated through silvicultural practices and prescribed burning. In Alternative D, the desired forest composition includes sustaining a greater abundance of upland and northern hardwood types. However, given the impacts of beech bark disease, it should be acknowledged that untreated northern hardwood

stands with a substantial beech component will contain a greater beech component in the future forest, which is susceptible to the introduced beech bark disease. Additionally, northern hardwoods with a large beech component will be structurally different than those present today, and likely be comprised of scattered overstory trees with dense thickets of root-sprout origin beech as described by Latty *et al.* (2003).

Table 3-25 displays the forest types predicted in each alternative in decades 1 and 2 of LRMP implementation. In the short term, or the next twenty years, oaks, northern hardwoods, hemlock, conifer, aspen, and mixed (less well stocked areas) forest types would be sustained at similar proportions to those found on the ANF today in all alternatives. Forest type changes take a number of years to occur, particularly in the absence of active management, depending on disturbances to forest canopies and understory vegetation conditions (including presence or absence of interfering vegetation and tree seedling species). Therefore forest types on the ANF are not anticipated to greatly change in the next two decades in any of the alternatives barring any catastrophic events. Reforestation practices would be implemented to encourage establishment and development of a diversity of tree species representative of overstory trees and existing forest types in all alternatives.

Table 3-26 displays the forest types predicted to develop in forested areas in each alternative by decade 6 of LRMP implementation. In general, areas managed under uneven-aged regeneration methods or with no active management are anticipated to trend towards upland and northern hardwoods in the long term. Areas managed using even-aged methods would generally tend to maintain forest types present on the ANF today. This is because the majority of forest types found on the ANF are comprised of primarily shade-intolerant and intermediate species, which require even-aged silvicultural systems to best maintain them (see Appendix A to LRMP, Vegetation Management Practices- Rationale for Choice). By decade 6 of implementation, all alternatives are anticipated to reflect some shifts in the relative abundance of forest types found on the ANF today. All alternatives would result in increases in upland hardwoods, with corresponding decreases in Allegheny, oak, and northern hardwoods. This is primarily due to the amount of forest land that would not be actively managed in each alternative and the amount of uneven-aged management applied. Additionally, the species that dominate upland hardwoods, particularly sweet birch and red maple are moderately tolerant of shade, allowing them become established and survive in the growing space created through the death of individual or small groups of trees. The species that dominate the upland hardwood type are also presently subject to fewer forest health concerns than species dominating the northern hardwood type (beech, sugar maple, and hemlock). However, it should be noted that few birch trees on the ANF exceed 60 years of age (Morin *et al.* 2006) due to native fungus species. Alternatives Cm and D would result in the greatest increase in upland hardwoods, while Alternative D would result in the largest concurrent decrease in Allegheny hardwoods by decade 6 (see also Table 2-3). This is due to the amount of uneven-aged management and amount of area not actively managed that would result in Alternative D, which favors shade-tolerant and intermediate forest types such as northern and upland hardwoods. Alternative Cm would sustain somewhat more of the oak type in the long term than the other alternatives.

When the desired condition involves perpetuating Allegheny hardwoods, aspen, and oaks in particular, even-aged management provides the best response and is most successful in these forest types (Roach 1972; Bjorkbom and Walters 1986; Horsley *et al.* unpublished 1998; Marquis and Gearhart 1983, p. 138; Perala and Russell 1983, p. 114; Sander *et al.* 1983, p. 117; Roach and Gingrich 1968). Alternatives A and B would sustain the most Allegheny hardwoods, primarily through even-aged management. Alternative D would sustain the least Allegheny hardwoods on the landscape.

Table 3-25. Forest type outcomes in decades 1 and 2 by LRMP alternative

Forest Type	Present (2006) Thousands of Acres (Percent)	Decade 1 Thousands of Acres (Percent of Forested land)				Decade 2 Thousands of Acres (Percent of Forested land)			
		Alt. A	Alt. B	Alt. Cm	Alt. D	Alt. A	Alt. B	Alt. Cm	Alt. D
Upland Hardwood	154.0 (33%)	154.0 (33%)	154.0 (33%)	154.0 (33%)	154.0 (33%)	154.0 (34%)	154.6 (34%)	154.2 (34%)	153.0 (34%)
Allegheny Hardwood	129.8 (28%)	129.8 (28%)	129.8 (28%)	129.8 (28%)	129.8 (28%)	124.3 (27%)	124.6 (27%)	125.2 (27%)	125.3 (27%)
Oaks	75.4 (16%)	75.4 (16%)	75.4 (16%)	75.4 (16%)	75.4 (16%)	75.0 (16%)	74.8 (16%)	75.4 (16%)	75.0 (16%)
Northern Hardwood	72.9 (16%)	72.9 (16%)	72.9 (16%)	72.9 (16%)	73.0 (16%)	72.1 (16%)	71.4 (16%)	72.1 (16%)	72.2 (16%)
Mixed (low stocked)	9.0 (2%)	9.0 (2%)	9.0 (2%)	9.0 (2%)	9.0 (2%)	9.0 (2%)	9.0 (2%)	7.5 (2%)	9.0 (2%)
Hemlock	9.4 (2%)	9.4 (2%)	9.4 (2%)	9.4 (2%)	9.4 (2%)	9.4 (2%)	9.4 (2%)	9.4 (2%)	9.4 (2%)
Conifer	10.3 (2%)	10.3 (2%)	10.3 (2%)	10.3 (2%)	10.3 (2%)	10.3 (2%)	10.3 (2%)	10.3 (2%)	10.3 (2%)
Aspen	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)
Total forested land¹	463.5	463.5	463.5	463.5	463.6	456.8	456.8	456.8	456.9

¹ The reduction in forest land from the present to decade 2 reflects an assumption that 6,660 acres will be converted to a non-forested condition during the first decade of implementation, due to privately owned oil and gas mineral developments. This is consistent with the assumptions listed in Appendix F. See Appendix B for additional details on SPECTRUM modeling assumptions relative to future oil and gas development.

Table 3-26. Forest type outcomes in decade 6 by LRMP alternative

Forest Type	Present (2006) Thousands of Acres (Percent of Forested Land)	Decade 6 Thousands of Acres (Percent of Forested Land)			
		Alt. A	Alt. B	Alt. Cm	Alt. D
Upland Hardwood	154.0 (33%)	199.2 (45%)	198.4 (45%)	204.2 (47%)	215.9 (49%)
Allegheny Hardwood	129.8 (28%)	93.3 (21%)	93.6 (21%)	90.6 (21%)	78.2 (18%)
Oaks	75.4 (16%)	60.9 (14%)	61.1 (14%)	63.5 (14%)	61.2 (14%)
Northern Hardwood	72.9 (16%)	55.1 (13%)	55.4 (13%)	54.2 (12%)	56.6 (13%)
Mixed (low stocked)	9.0 (2%)	9.0 (2%)	9.0 (2%)	5.0 (1%)	5.6 (1%)
Hemlock	9.4 (2%)	8.9 (2%)	8.9 (2%)	8.9 (2%)	8.9 (2%)
Conifer	10.3 (2%)	7.8 (2%)	7.8 (2%)	7.8 (2%)	7.8 (2%)
Aspen	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)	2.7 (1%)
Total Forested Land¹	463.5	436.9	436.9	436.9	436.9

¹ The reduction in forest land from the present to decade 6 reflects an assumption that 26,000 acres will be converted to a non-forested condition, due to privately owned oil and gas mineral developments. This is consistent with the saturation (20,000 wells) assumption listed in Appendix F. See Appendix B for additional details on SPECTRUM modeling assumptions relative to future oil and gas development.

Uneven-aged management is not expected to sustain these shade-intolerant forest types; though some individuals of shade-intolerant species such as northern red oak, black cherry, yellow poplar, and aspen may persist, they will be far less abundant in areas managed under an uneven-aged system. Uneven-aged management trials in Appalachian hardwoods in West Virginia resulted in the development of shade-tolerant reproduction expanding at the expense of more shade-intolerant species after partial cutting, which eventually leads to a decline in species diversity (Miller and Kochenderfer 1998, Kochenderfer *et al.* 2004). In the long term, uneven-aged management, particularly single tree selection, favors shade-tolerant species (Stout 1994, p. 333) such as sugar maple (sensitive to site nutrients and subject to decline on nutrient poor sites), beech (subject to introduced beech bark disease complex), and eastern hemlock (subject to hemlock woolly adelgid). Group selection favors more shade intolerant and mid-tolerant species than single tree selection. The end result would be a transition towards northern and upland hardwood forest types in treated areas, and a reduction in the abundance of shade-intolerant forest types such as aspen, Allegheny hardwoods, and oaks in treated areas. In Alternative A, group selection sizes of up to one half acre would be utilized, which would result in a trend towards northern hardwoods in treated areas. Alternatives B, Cm, and D all incorporate the use of larger group sizes (1-3 acres), which would better maintain forest types consisting primarily of shade-intolerant and intermediate species on the ANF. However, an overall trend towards upland hardwoods is anticipated where uneven-aged management is applied.

Forest age and stocking

The desired condition for forest vegetation in all alternatives includes sustaining a diversity of vegetative structural stages and age classes across the landscape, including diverse forest understories with multiple layers, within the context of multiple use management. Forested areas on the ANF would range from third-growth early structural stages to late structural stages in all alternatives, to varying degrees. Both horizontal and vertical vegetative diversity would be provided on the ANF landscape, and a multi-layered vegetative forest canopy would be present in many riparian areas.

Alternatives A, B, and Cm place a greater emphasis on sustaining horizontal diversity across the landscape. Alternative D has a desired condition of sustaining forest structural and age classes closer to that which existed on the ANF prior to European settlement. Alternative A provides late structural vegetation across the ANF in a less connected manner than the other alternatives. In order to sustain mature forest conditions for wildlife, Alternative A would utilize primarily even-aged management on long rotations. In Alternatives B, Cm, D late structural vegetation is provided in a more connected manner on landscape, with a greater emphasis placed on restoring vertical canopy layers and structural complexity. Alternatives B, Cm, and D would treat invasive, interfering understories and use a blend of uneven-aged, even-aged, and passive (no) management to help achieve desired conditions for late structural vegetation, and sustain desired late structural habitat for wildlife.

Even-aged regeneration treatments result in younger stands generally of a single age. Adding these younger age classes results in a number of age classes and tree sizes across the landscape, or enhanced horizontal diversity. Some degree of vertical structure results from even-aged management, due to the different sizes of various tree species found on the ANF. These areas of young trees benefit wildlife species that utilize an early structural forest component. Maintenance of sufficient early structural habitat to sustain associated wildlife communities will require active management (Brooks 2003). Conversely, areas managed using uneven-aged regeneration methods would result in greater within-stand vertical structural diversity than even-aged treatments, but less horizontal

structural diversity. Uneven-aged management tends to benefit mature forest wildlife species that require large trees, vertical structure, and small canopy gaps. Taken together, a combination of even-aged management, uneven-aged management, and no vegetation management across the ANF landscape will help sustain biodiversity and provide a variety of structural conditions for a number of resource purposes. See the plant and animal community section (3.3.2) of this FEIS for more detail.

Changes in stand age

Change in stand ages on the ANF is projected over a 150-year planning horizon, with decades 1, 2, and 6 of LRMP implementation discussed in this section. The age class distribution depends on time, the amount of even-aged regeneration cutting anticipated in each alternative, and the timing of treatments. Management area allocations prescribe where vegetation management may occur, as well as the silvicultural system and intensity of management in order to achieve desired conditions of each alternative. The amounts of treatments vary by alternative and result in landscape level differences in the distribution of age classes across the ANF.

Table 3-27 displays the age class distribution that is anticipated to result in each alternative in decades 1 and 2 of LRMP implementation. Areas managed under uneven-aged regeneration methods would eventually result in a multi-aged condition, with a variety of size classes from seedlings to large trees present in treated areas, and are displayed in the bottom row of the Table.

All alternatives propose even-aged management and even-aged forest regeneration methods, though to varying degrees. Even-aged regeneration methods (e.g. shelterwood removal cut, final harvest, or clearcut) would create young age-classes that would be interspersed with older age classes on the landscape, and would result in greater structural class diversity at the landscape scale, and a more resilient forest to insect or disease outbreaks as described by Nyland (1996 p. 466). Reforestation treatments designed to develop abundant, diverse tree seedling development and survival would promote long-term sustainability of diverse, well stocked forest stands. Alternative D would foster some tree regeneration and long-term sustainability of well stocked, high value stands, but to a much lesser extent than Alternatives A, B, and Cm. Alternative D would feature more uneven-aged management for multi-aged treated areas, and maintenance of high forest canopies. All alternatives would maintain and allow further development of mature forest conditions in management areas that feature mature or late structural forest conditions, such as MA 2.2, 5.0, 6.1, 7.2, 8.1, 8.2, 8.3, and 8.5. Like the amount of even-aged regeneration that occurs, the amount of mature forest conditions featured varies by alternative and associated management area allocation. See the following section on late-structural/old growth forest for more detail.

Table 3-27. Age class outcomes in decades 1 and 2 by LRMP alternative

Age Class (Years)	Present (2006) Thousands of Acres (Percent of Forested Land)	Decade 1 Thousands of Acres (Percent of Forested Land)				Decade 2 Thousands of Acres (Percent of Forested Land)			
		Alt. A	Alt. B	Alt. Cm	Alt. D	Alt. A	Alt. B	Alt. Cm	Alt. D
0-20 (Seedling/Sapling)	36.7 (8%)	48.5 (11%)	48.1 (11%)	45.1 (10%)	39.8 (8%)	45.2 (10%)	43.9 (10%)	36.8 (8%)	21.8 (5%)
21-50 (Pole-sized)	27.7 (6%)	27.7 (6%)	27.7 (6%)	27.7 (6%)	27.7 (6%)	49.7 (11%)	49.6 (11%)	49.5 (11%)	49.4 (11%)
51-80	118.0 (26%)	117.0 (25%)	110.8 (24%)	110.4 (24%)	99.9 (22%)	40.0 (9%)	38.2 (8%)	38.1 (8%)	33.8 (7%)
81-110 (Mature)	266.1 (57%)	252.1 (55%)	244.9 (53%)	245.0 (53%)	224.8 (49%)	267.2 (59%)	257.7 (57%)	261.8 (58%)	241.7 (53%)
111-140	11.7 (3%)	11.4 (2%)	11.5 (3%)	11.5 (2%)	10.1 (2%)	47.4 (10%)	46.3 (10%)	46.3 (10%)	48.2 (11%)
141-300 (Late Structural/Transitional Old Growth)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0.6 (<1%)	0.6 (<1%)	0.6 (<1%)	0.6 (<1%)
301+ (Old Growth)	3.3 (<1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)
Allocated to uneven-aged silvicultural system (multi- aged)	n/a	0.1 (<1%)	13.8 (3%)	17.1 (4%)	54.8 (12%)	0.1 (<1%)	13.8 (3%)	17.1 (4%)	54.8 (12%)

The present age, structure, and maturity of the forest on the ANF are fairly uniform. Second growth forests within the ANF generally range from 50 to 110 years old, with forest over 50 years old occupying 86 percent of the ANF and more than half (57%) of the ANF falling within a single thirty year age class: 81-110 years old (see Table 3-20). Only 8 percent of the ANF is in the youngest age class (0-20 years old), and just 3 percent is older than 111 years, a considerable imbalance.

This uniform, mature second growth forest is vulnerable to damage from repeated natural stresses, which may impact forest health more readily than a forest comprised of a more balanced age class distribution. Landscapes consisting of stands of similar sized and aged trees are more vulnerable to damage from a particular pest than if the landscape were composed of stands and forests of a variety of size and age classes (Waring and O'Hara 2005). Alternatives A, B, and Cm place a greater emphasis on improving structural-age class diversity across the ANF by establishing younger, more vigorous age classes than Alternative D.

Conversely, others feel forest health is more related to maintenance of a forest matrix and biodiversity conservation achieved through activities that support populations of species, regulating the movement of organisms, buffering sensitive areas and reserves, and maintaining the integrity of aquatic systems through maintaining vegetative connectivity (Lindenmayer and Franklin 2002, Chapter 1). Alternative D, which employs greater use of uneven-aged management and allocates more land area to management area prescriptions where active vegetation management would not occur, would maintain more continuous high forest canopy across the ANF landscape as a whole, and result in smaller openings in the forest canopy. Even-aged harvests in Alternative D are scheduled to achieve a desired condition of 2-4 percent of the ANF landscape in young forest (0-20 years old), consistent with the historical disturbance regimes for the area (see discussion under affected environment for vegetation, natural disturbance section). Alternative D would introduce the least amount of discontinuity in the forest canopy as a result of vegetation management. At the same time, the overall lack of harvesting, particularly regeneration treatments, would likely result in decreased browse availability on the landscape and consequently increased deer browsing impacts to understory vegetation in Alternative D.

As can be seen from Table 3-27, there are small differences in the amount of seedling/sapling age class (the 0-20 year age class) that would be provided in Alternatives A, B, and Cm in the next 20 years. There is an emphasis on the sustained development of new age classes in Alternatives A and B, and to a lesser degree Alternative Cm. All alternatives focus on completing the regeneration process that was initiated in stands prior to this LRMP, by completing the shelterwood removal harvests on areas that have already received a shelterwood seed cut. Even-aged regeneration harvests would create new 0-20 year old stands, primarily in MAs 1.0 and 3.0. As time passes, existing and created 0-20 year old vegetation will age, grow, and move into the pole-size class (the 21 – 50 year age class). This is to better balance age class distribution, and emphasize regeneration of shorter lived forest types like Allegheny hardwoods, which are anticipated to begin declining in the coming decades. One result of this emphasis on the continued development of younger age classes is to create a mosaic of age classes across the ANF as described by Waring and O'Hara (2005). Alternative D, conversely, features more late-structural, older forest vegetation, with a greater use of uneven-aged management proposed to achieve desired vegetation conditions. This alternative would result in the least amount of young forest (0-20 year old age class) across the landscape, sustaining less forage for deer, and likely resulting in increased deer browsing impacts on tree seedlings and herbaceous vegetation. However, in areas actively treated using uneven-aged management, multi-aged stands and continuous high forest canopy would be expected.

As can be seen from Table 3-27, over the next 20 years, all of the alternatives would provide similar amounts of older forest. This is largely a function of the existing age of forest vegetation on the ANF. Additional land was allocated to management areas that will provide late structural conditions and old forest over the long term in Alternatives B, Cm, and D.

Table 3-28 below displays the age class distribution that is anticipated to result on the ANF under each alternative in decade 6 of LRMP implementation. Areas managed under uneven-aged regeneration methods would result in a multi-aged condition and are displayed in the bottom row of the table.

Concerns exist locally, about long-term forest health and maintaining forest cover as large areas of the ANF progress to older ages, particularly when interfering plants dominate the understory and tree seedlings are sparse. These concerns would be lowest in Alternatives A, B, and Cm where there is a greater emphasis on improving structural-age class diversity across the ANF by establishing younger, more vigorous age classes in some areas through even-aged management, along with maintaining older age classes in other areas (Nyland 1996, p.466, Waring and O'Hara 2005), and highest in Alternative D, which would result in the least amount of structural-age class diversity.

By decade 6 of LRMP implementation, the most abundant supply of 0-20 year age class (15%) would occur in Alternative A, followed closely by Alternative B (14%). This can be seen in Table 3-28. Alternative D would sustain the least amount (3%) of young forest on the landscape. This would likely result in decreased browse availability on the landscape and consequently increased deer browsing impacts to understory vegetation. Roughly half of the ANF would be over 110 years old in Alternatives A, B, and Cm by the sixth decade of implementation, compared to 3 percent that is presently this older than 110. Over the next 60 years, Alternatives A, B, and Cm would provide similar amounts of forest older than 140 (22%). This is primarily a function of time and the existing age of forest vegetation on the ANF. Alternative D would result in greater amounts of vegetation greater than 110 years old (65%) and greater than 140 years old (29%). Alternative D would also result in the largest proportion of the ANF (55%) allocated to the uneven-aged silvicultural system with multiple age classes eventually present in treated areas.

Table 3-28. Age class outcomes in decade 6 by LRMP alternative

Age Class (Years)	Present (2006) Thousands of Acres (Percent of Forested Land)	Decade 6 Thousands of Acres (Percent of Forested Land)			
		Alt. A	Alt. B	Alt. Cm	Alt. D
0-20 (Seedling/Sapling)	36.7 (8%)	65.6 (15%)	58.8 (14%)	48.6 (11%)	12.4 (3%)
21-50 (Pole-sized)	27.7 (6%)	58.6 (14%)	57.6 (13%)	51.9 (12%)	20.9 (5%)
51-80	118.0 (26%)	45.2 (10%)	45.5 (10%)	45.5 (10%)	44.2 (10%)
81-110 (Mature)	266.1 (57%)	19.0 (4%)	17.8 (4%)	18.5 (4%)	20.5 (5%)
111-140	11.7 (3%)	148.1 (34%)	146.0 (33%)	155.4 (36%)	156.3 (36%)
141-300 (Late Structural/Transitional Old Growth)	0 (0%)	96.9 (22%)	94.0 (22%)	96.4 (22%)	124.5 (28%)
301+ (Old Growth)	3.3 (<1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)	3.3 (1%)
Allocated to uneven-aged silvicultural system (multi-aged)	n/a	0.1 (<1%)	13.8 (3%)	17.1 (4%)	54.8 (12%)

Multi-aged, late structural, and old growth forest

Table 3-29 displays characteristics of the vegetation within the area that would be allocated to provide multi-aged, late structural and future old growth conditions in each alternative during the second decade of implementation. The entire existing remnant old growth forest on the ANF is included in this area under all of the alternatives. In order to provide for future old growth, site specific projects implemented under 1986 Forest Plan direction resulted in the designation of isolated areas scattered across the landscape where future late structural vegetation would be featured. All previously designated areas, totaling 5,800 acres, would be retained in Alternative A.

Alternatives B, Cm, and D all incorporate a landscape approach to providing future late structural forest on the ANF. These alternatives all add a new Management Area, MA 2.2, which would be managed to provide older, structurally complex forest in a connected pattern across the landscape. A primary objective for these areas is to maintain connectivity between existing remnant old growth and other core areas managed for late structural conditions on the ANF. Additionally, Alternatives B, Cm, and D all would retain some of the previously designated isolated areas that fall outside of MA 2.2, to also provide potential late structural and future old growth forest. Alternative B would retain 2,400 acres, Alternative Cm 4,000 acres, and Alternative D 3,800 acres of areas previously designated to provide late structural conditions. These isolated areas are located in MAs 1.0, 2.1, 3.0, 6.1, 7.1 and 8.6.

Table 3-29. Characteristics of areas allocated for multi-aged, late structural, or old growth vegetation in each alternative – decade 2

	Acres			
	Alternative A	Alternative B	Alternative Cm	Alternative D
Total acres (percent of ANF) managed for Late Structural/Old Growth Conditions (MAs 2.1, 2.2, 5.1, 5.2, 6.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.5, and 9.1)	165,200 (33%)	162,000 (32%)	204,500 (40%)	371,100 (73%)
Forest Types (percent) comprising the Area Allocated for Late Structure/Old Growth Conditions				
Northern Hardwood, Hemlock	24	21	22	20
Oaks, Upland Hardwoods, Conifer, Mixed Hardwoods	64	63	60	57
Allegheny Hardwood, Aspen	12	16	18	23
Ages (percent) comprising the Area Allocated for Late Structure/Old Growth Conditions				
Old Growth (>301 Years Old)	2	2	2	1
Late Structural (151-300 Years Old)	0	0	0	0
Mature (51-150 Years Old)	91	91	91	88
Young (21-50 years old)	6	6	6	9
Early structural (0-20 years old)	1	1	1	2

Alternatives A and B would allocate similar amounts of the ANF to provide late structural conditions and older forests, while the desired condition for Alternatives Cm and D includes additional amounts of late structural, older forests. Alternative D allocates nearly three-quarters of the ANF to provide late structural conditions and older forests. Alternative A allocates much more land area to MA 6.1 than any of the other alternatives, which would provide mature forest conditions through even-aged management on long rotations. Alternative D includes 126,000 acres of MA 2.1 where uneven-aged management would be applied to maintain stands with multiple age classes and predominantly continuous high forest canopy. The successfulness of this will depend on the amount of acreage treated, overall deer browsing impacts, and use of intensive reforestation treatments.

As can be seen from the table, over 90 percent of the area allocated for late structural forest would be 50-150 years old in each of the alternatives in decade 2 of implementation. Less than 1-2 percent consists of existing remnant old growth forest, though this represents 100 percent of existing remnant old growth on the ANF in all alternatives. During decade 2 of implementation, about 6 to 9 percent would consist of young forest (21-50 years old) in each of the alternatives, and 1-2 percent would be early structural (0-20 years old) forest vegetation. The amount of young and early structural vegetation that would result in each alternative depends on the amount of land area allocated for late structural conditions and future old growth. The amount of early structural vegetation that would be sustained in the area featuring late structural conditions in each alternative is to some degree consistent with the naturally occurring age class distribution present in the TSRNA. As noted previously, the remnant forest of TSRNA contains four distinct age classes due to large scale disturbances in 1808, 1870, and 1985, and approximately 17 percent of this primary forest (naturally occurring) is currently less than 20 years old due to a tornado in 1985.

A variety of forest types commonly found on the ANF would be represented in the area proposed for late structural conditions and future old growth in each of the alternatives. As old growth conditions are estimated to take at least 250 years to develop (Spies 2004), it is important to feature long-lived tree species when managing for old growth conditions over the long term. Of the forest types displayed in the table, northern hardwood (sugar maple, American beech, eastern hemlock mix) and hemlock were historically the longest lived before the advent of exotic insects and diseases, based on the species comprising them. Mixed upland and oak hardwoods, along with conifer (primarily red pine) can also be relatively long-lived, depending on the species composition of individual areas. In total, forest types consisting of historically longer lived species comprise between 20 and 24 percent of the total land area that would be allocated for late structural conditions under any of the alternatives. Forest types that can be considered moderately long-lived on the ANF comprise an additional 57 to 64 percent of the total land area allocated for late structural conditions or future old growth under any of the alternatives. Forest types that are considered shorter lived, such as Allegheny hardwoods and aspen, comprise 12 to 18 percent of the total land area allocated for late structural conditions in Alternatives A, B, and Cm. Shorter lived forest types comprise 23 percent of this land area in Alternative D due to the existing composition of additional areas allocated to MAs 2.2, 5.1, 5.2, and 7.2 in this alternative.

Table 3-30 displays estimated characteristics of the vegetation within the area that would be allocated to provide late structural and future old growth conditions in each alternative by the sixth decade of implementation. As can be seen from the table, though each alternative allocates a different amount of

land to provide late structural conditions in the long term, similar age class distributions would result in the area by decade 6. This is primarily a function of time and the existing age of forest vegetation in areas allocated for future late structural vegetation in each of the alternatives.

Alternative A would sustain 7 percent early structural and young forest (less than 50 years old) in these areas, compared to 2 to 3 percent in any of the other alternatives. This is less than the amount of young forest presently found in the TSRNA (17% is presently less than 20 years old).

Beech-maple, hemlock-spruce old growth forests of the northeast have been characterized as requiring centuries to develop, with a high degree of vertical structure and large to very large, long-lived (>250 years) trees, and fine grained patch size (Spies 2004). Some have estimated it will take more than a century for the forests in the eastern United States to mature and develop all the structural complexity and diverse age class distributions they currently lack if left idle (Litvaitis 2003a). These processes could take even longer given impacts created by the introduced beech bark disease, potential impacts from the introduced hemlock woolly adelgid, and excessive browsing impacts from deer, which disrupt natural succession and stand development processes. However, as noted by Runkle (1991) management actions to mimic gap and snag dynamics cannot replace all functions of an old growth forest but may allow certain species and processes to establish at a site several decades earlier than they would by natural changes.

Table 3-30. Characteristics of areas allocated for multi-aged, late structural, or old growth vegetation in each alternative – decade 6

	Acres			
	Alternative A	Alternative B	Alternative Cm	Alternative D
Total acres (percent of ANF) managed for Late Structural/Old Growth Conditions (MAs 2.1, 2.2, 5.0, 6.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.5, and 9.1)	165,200 (33%)	162,000 (32%)	204,500 (40%)	371,100 (73%)
Forest Types (percent) comprising the Area Allocated for Late Structure/Old Growth Conditions				
Northern Hardwood, Hemlock	21	18	19	17
Oaks, Upland Hardwoods, Conifer, Mixed Hardwoods	72	72	71	68
Allegheny Hardwood, Aspen	7	10	10	15
Ages (percent) comprising the Area Allocated for Late Structure/Old Growth Conditions				
Old Growth (>301 Years Old)	2	2	2	1
Late Structural (151-300 Years Old)	11	11	11	11
Mature (51-150 Years Old)	80	84	85	86
Young (21-50 years old)	3	1	1	1
Early structural (0-20 years old)	4	2	1	1

Most restoration of old growth in the eastern U.S. is occurring passively, without active management to accelerate development of selected old-growth attributes. However, there is a growing body of literature on applying silvicultural techniques to accelerate or hasten the development of selected old growth characteristics or components (Oliver and Larson 1996, pages 281-282; Runkle 1991; Trombulack 1996; Franklin 2001; Franklin and Van Pelt 2004; Jenkins *et al.* 2004; Vora 1994; Singer and Lorimer 1997; Nyland *pers. comm.* 1998 and 2004; Litvaitis 2003; Lorimer and Frelich 1994). As noted by Trombulack (1996, p. 311) the restoration of old growth may require more than simply “letting the forest be.” A heavily altered landscape, which characterizes much of the forest land in the U.S., experiences many stresses that slow the development of late structural and old growth attributes, such as high populations of herbivores and exotic pests. Therefore, the restoration of old-growth may require adaptive or restorative management until succession in the forested system becomes self-reinforcing.

A passive approach to old growth development in second growth stands would maintain a high degree of naturalness, which is recognized as being important to old growth values and processes. As noted by Tyrrell (1996) it is important to distinguish between old-growth, extended rotations, and stands manipulated for old-growth characteristics. Tyrrell asserts that silvicultural treatments that extract timber or attempt to accelerate succession do not contribute to naturalness, an important feature of ecological, or natural old growth. Nyland (*pers. comm.* 1998) recognizes that some old growth attributes are dependent on site, natural disturbance, and time, and are not easily affected by silviculture. Examples include undisturbed soil, pit and mound surface relief, thick organic layer, and below ground cavities under large roots.

The potential for restoration of old-growth on the Allegheny Plateau is significantly affected by several factors: most second growth forests created by historical logging are different in composition and structure than the original forests present prior to European settlement, introduced forest pests such as the beech bark disease are dramatically altering both the overstory and understory structure of some areas, and a legacy of excessive deer browsing impacts on understory vegetation. Examples include areas with understories dominated by fern or beech brush resulting from beech bark disease, uniform mid-structural stands, and stands lacking structural diversity. Therefore, in some cases, silvicultural treatments are appropriate to accelerate the development of selected late structural and old growth structural features such as large trees, canopy gaps, multi-layered canopies, complex structural diversity, dead and down wood on the forest floor, and snags. At the same time, efforts can be made to ensure the composition of the forest, as it evolves and develops late structural and old growth characteristics, is composed of a diversity of species to ensure a healthy, long-lived forest. This can be accomplished through opening the forest canopy to allow development of seedlings that will develop into understory and midstory structure, applying herbicide to remove vegetation that interferes with development of a diverse understory, fencing areas to reduce impacts of browsing by deer to promote a diversity of seedlings, and releasing seedlings through small group openings that are generally designed to mimic natural disturbance.

Several silvicultural prescriptions were developed specifically for use on the ANF in second-growth hardwood stands, primarily in portions of MA 2.2, to accelerate development and restoration of late structural or eventual old growth structural attributes. These attributes include large trees, canopy gaps, diverse multi-layered vegetation, and complex structural conditions. The proposed treatments and their

anticipated effects are described in the direct and indirect effects of vegetation treatments section, effects common to all alternatives. See Appendix A to the LRMP, Vegetation Management Practices- Rationale for Choice, for more detailed discussion of these treatments. MA 2.2 is the primary area that features the use of silvicultural prescriptions to accelerate development and restoration of late structural conditions and eventual old growth characteristics. Other portions of MA 2.2 would be passively managed, and these characteristics would develop naturally over time. Treatments to develop late structural characteristics may also be used to enhance riparian area structure or wildlife habitat, or maintain scenic quality. Treated areas are expected to develop selected attributes sooner and promote tree species not subject to forest health concerns, than those areas passively managed. It is recognized that these silvicultural treatments would not promote natural disturbance characteristics such as pit and mound micro-topography or bole snap. In the unmanaged second growth forest in the ANF (8 to 31percent of the landscape, Alternatives A and D respectively, see Table 2-3), these conditions, including pit and mound micro-topography, windthrow and bole snap, will develop naturally through passive management, and ecological old growth would be featured. In Alternative Cm, roughly one-quarter of the ANF would be passively managed for these conditions. Though old-growth characteristics would develop over a longer period of time, a higher degree of naturalness would be provided.

Portions of MAs 2.2 and 6.1 would be actively managed using even-aged silvicultural systems to sustain an early structural component and maintain shade-intolerant species such as oaks and aspen. A blend of uneven-aged and two-aged management would be used in other shade-intolerant or mid-tolerant forest types such as Allegheny and upland hardwoods and conifers, with the overall intent to developing late structural characteristics. Uneven-aged management would be used to sustain northern hardwood and hemlock forest. MA 2.2 would also feature substantial use of passive (no) management to achieve late structural conditions. MA 2.1 will be managed to develop multiple ages of trees in treated areas and sustain predominantly continuous high forest canopy. MAs 5.1, 5.2, 7.2, 7.3, 8.1, 8.2, 8.3, 8.5 and 9.1 would all develop and/or maintain late structural and old growth forest primarily through passive management, maintaining a high degree of naturalness as described by Tyrell.

Overall, areas allocated for late structural and future old growth conditions in each alternative vary little in their quality with regard to species composition and age classes. They vary primarily in how the late structural and old growth conditions would be featured across the landscape (distribution) and in the total amount provided in each alternative.

Stocking

One of the primary objectives of ANF forest management is to maintain healthy, well stocked stands in forested conditions capable of providing a variety of products and amenities (LRMP, Chapter 2, Vegetation Management Goals). It is important to maintain well stocked stands to provide a healthy forest for numerous values including wildlife, scenic integrity, and water quality. This means that stands are maintained in a condition that utilizes the site, and are capable of sustaining a well-stocked forested condition over time.

Stocking levels (relative densities) are anticipated to remain fairly steady in the short term as stands mature and fill in, other areas decline and experience tree mortality that reduces stocking levels, and management activities maintain well stocked stands in all alternatives over the next 20 years. The exception to this would be beech stands, or areas with a substantial beech component, where beech tree mortality will likely result in lower overall stocking levels over the next 20 years, and a structural shift to smaller diameter understory trees. Beech mortality (already evident in the northern portion of the ANF) will become particularly evident on the southern portion of the ANF, where the advancing front of the disease complex is present, and the killing front is in the process of arriving. Other factors that will affect the stocking of forested areas on the ANF include wind throw, defoliation events, and decline (sugar maple and ash).

Alternatives A, B, and Cm, which emphasize the use of even-aged management, would likely result in the highest level of regeneration of older, poorly stocked stands into young, fully stocked stands. Over the long term, Alternative D, which places greater emphasis on active uneven-aged management or passive (no) management, would likely treat fewer of these poorly stocked stands. Under an uneven-aged system it is not as feasible to treat poorly stocked stands, given less well stocked overstories and the need to invest in an increased number of reforestation activities.

Understory and midstory condition

Since tree mortality/decline and defoliation began to occur in the early 1990s, changes have occurred in the understory on the ANF. Generally, ground cover plants (particularly ferns and grasses) present have grown and become more dense because of increased sunlight. Over time, this adversely affects those plants that do not grow to larger sizes or dominate sites. For example, ferns will grow to two and sometimes three feet in height, forming a dense layer and shading out dog-tooth violets, wood sorrel and trout lily in the ground layer. They also affect woody plants that are capable of growing to larger sizes, since in the seedling stage many tall growing species are very vulnerable to browsing, and decline and mortality under poor lighting conditions.

On the ANF, vertical diversity has been greatly affected by past and on-going deer browsing and interference from native invasive plant species, and is therefore lacking in many areas. Normally, gaps in the overstory canopy from the deaths of individual trees or natural disturbance would result in trees and shrubs eventually occupying the gaps. However, on the Allegheny Plateau, deer repeatedly browse wildflowers, herbaceous vegetation, shrubs and seedlings, virtually eliminating the shrub understory and greatly reducing the number of seedlings and herbaceous plants (Tilghman 1989; Jones *et al.* 1993; deCalesta 1994; deCalesta 1998; Horsley *et al.* 2003; Whitney 1984). Only 9 percent of the ANF (

Table 3-22) contains adequate seedlings taller than one foot to sustain forest cover (Morin *et al.* 2006), thereby reducing the potential for improved vertical diversity. Over the long term, this raises questions about tree composition and species changes in management areas where the LRMP permits little human intervention to control forest and ground vegetation structure, composition, and development. Where management activities are permitted, treatments such as herbicide application, site preparation, timber stand improvement (release), and area fencing are all activities that can alleviate the impacts of browsing by deer. This is through either directly reducing the abundance of interfering vegetation, which allows a

greater diversity of seedling, shrub, and herbaceous vegetation to become established, or through excluding deer from browsing understory vegetation.

All alternatives include activities to restore understory vegetative diversity and vertical structure, though to varying degrees. The desired condition includes forest understories that contain multiple, diverse vegetative layers that are resilient and capable of sustaining well stocked, healthy hardwood forests in the long term. If recently reduced deer populations are sustained on the ANF, understory vegetation and structural diversity should improve in the long term. However, understory response lags behind the deer population drop even though browsing intensity has declined (deCalesta 2005). Because of this, across the ANF as a whole, interfering vegetation is expected to remain constant in the next few decades, and will require treatment to provide conditions for diverse seedling and herbaceous vegetation to become established.

Application of herbicide would provide opportunity for some increase in species diversity and distribution. Herbicide is used to reduce competing vegetation (fern, grass, striped maple, and beech), which often prevents tree seedlings from becoming established in the understory. Local research has shown that when more than 30 percent of the survey plots taken in a stand have substantial amounts of plants capable of limiting the development of other desired species, there is a need to remove many of those plants so other species have a chance to develop (Horsley *et al.* 1994, pp. 216, 218, 231-238). In a 1994 survey of areas with tree mortality, vegetation that interferes with tree seedling and other plant development and growth was present in sufficient quantities to require treatment, as described by Horsley *et al.* (1994, pp. 214-216), in 93 percent of the stands evaluated on the ANF (McWilliams *et al.* 1996).

Following treatment with herbicide, a wider range of plant communities could be expected to occupy the understory (Horsley 1994, Ristau *et al. pers. comm.* 2005). This could include tree species as well as shrubs, forbs, and wildflowers, which are presently absent. Recent monitoring of the effect of herbicide application in conjunction with a shelterwood over a ten year period found higher plant diversity and lower single species dominance on plots treated with glyphosate and sulfometuron methyl (Ristau *et al. pers. comm.* 2005). Fencing the areas in the study removed deer browsing pressure and resulted in additional recovery of herbaceous species and increased tree seedling height growth. Though many of those interfering plants would eventually re-occupy treated sites, the window of opportunity created through removing interfering vegetation would allow seedling regeneration to become established, prior to re-establishment by interfering vegetation. Additionally, the density of interfering vegetation should be much lower for a number of years.

Site preparation would provide for some change in species diversity and distribution. Site preparation is used to reduce competing vegetation (striped maple, beech, birch, and other woody vegetation), which often prevents tree seedlings from becoming established in the understory. It should be noted that both beech and striped maple would provide an acceptable midstory canopy for those wildlife species requiring a midstory structure, though both of these species are relatively short lived and neither of which is anticipated to mature to an overstory canopy tree.

Table 3-31. Estimated average annual amount (decades 1 and 2) of understory treatments to improve understory and midstory condition

	Acres (rounded to Nearest 100)			
	Alternative A	Alternative B	Alternative Cm	Alternative D
Herbicide Application	1,700	1,900	2,000	800
Site Preparation	1,500	1,700	1,800	700
Release to Enhance Diversity	1,700	1,800	2,000	900
Fencing	1,100	1,300	1,800	600

Stand improvement (release) activities are designed to maintain or enhance species diversity and quality of young seedling stands in the process of regeneration. Release and pre-commercial thinning are an investment into future stand composition and stocking.

Area fencing would provide an increase in species diversity and distribution by preventing deer from browsing tree seedlings and other understory vegetation. Vegetation that develops within fences is usually more abundant and diverse than that which is found outside of fences.

All of these treatments are designed to enhance conditions for a diversity of tree seedlings and herbaceous vegetation to become established. In total, Alternative Cm, followed by Alternative B, would treat the greatest number of acres to restore diverse, abundant vegetation, and enhance understory and midstory structure in forest understories presently dominated by interfering vegetation (Table 3-31). Alternative A follows these two alternatives, and Alternative D would treat the fewest acres annually.

Where uneven-aged treatments are proposed in MA 2.2, enhanced understory and midstory structural conditions are anticipated in treated areas. Alternatives B, Cm, and D all include potential treatments to accelerate development of late structural vegetative characteristics. Riparian vegetation treatments are included in all alternatives, and are designed to enhance understory and midstory structural conditions in areas presently lacking understory structure, primarily through two-aged or uneven-aged harvests. Alternative A would treat the most acres of riparian areas annually in the first two decades of plan implementation (103-107 acres) to enhance structural conditions, whereas Alternative D would treat the least (61-64 acres) (see Table 2-2).

Forest health

Desired conditions relative to forest health in each of the alternatives emphasize sustaining a diversity of vegetation conditions with improved resiliency of forest vegetation on the ANF and reduced levels of impacts from forest insects and diseases. Forestwide goals include providing a diversity of vegetation patterns across the landscape that present well distributed habitats, a range of forest age classes and vegetative stages, a variety of healthy functioning vegetation layers, and a variety of vegetation species or forest types necessary to achieve multiple resource objectives. Integrated pest management methods are emphasized in all alternatives to prevent or minimize pest problems by using the most current science and available control methods, including silvicultural treatments, maintenance of species diversity, pesticide application, and introduction of insect predators or parasites.

Three evaluation criteria have been identified to assess the relative effect each alternative would have on forest health. These criteria to compare include:

- acres thinned
- acres of northern hardwood and hemlock forest types,
- acres of Allegheny hardwoods greater than 120 years old

Acres thinned

The first criteria used to compare anticipated effects on forest health by alternative will be intermediate thinning. Intermediate thinning stimulates growth and vigor of residual trees, and controls mortality by reducing intertree competition and removing trees susceptible to insects and diseases (Nyland 1996, pp. 362-364). As shown in Table 2-3, Alternative A would result in the greatest amount (25,100 acres) of intermediate thinning in decades 1 and 2 of implementation, followed by Alternative Cm (20,000 acres). Alternative B (16,900 acres) would thin less, and Alternative D would result in the least amount of thinning (5,100 acres) of any of the alternatives- nearly 5 times less than Alternative A. Viewed as a proactive way to improve the health of residual trees, Alternative A would reduce losses to unpredicted forest health threats by thinning more acres, while Alternative D would carry a higher risk for tree mortality.

Alternative A would result in the most acres thinned during the next 6 decades, or an estimated 76,000 acres thinned during decades 1 through 6 of LRMP implementation. Alternative B follows A, with a projection of 54,400 acres of thinning by decade 6. Alternative Cm would thin 40,700 acres, while Alternative D would thin the least amount during the same time period, 10,700 acres.

Acres of northern hardwood and hemlock forest types

The health of some tree species or areas of the ANF are being affected disproportionately, particularly when subjected to multiple stresses over a relatively short period of time (several years). The health of the northern hardwood forest type on the ANF, dominated by a combination of American beech, sugar maple and eastern hemlock, is of particular concern. American beech is subject to continuing mortality and decline from the beech bark disease complex, sugar maple health on the unglaciated Allegheny Plateau is limited by site-nutrient characteristics, and eastern hemlock is at risk from future introduction of the HWA. Therefore, one criterion to evaluate the relative risk of forest vegetation on the ANF to current health threats will be the acres of northern hardwoods and hemlock forest types that would result from the management prescriptions in each alternative. According to the information presented in Table 2-3, Alternatives A, B, Cm, and D would result in very similar amounts of northern hardwoods and hemlock forest types in decade 2 of LRMP implementation.

By decade 6, Alternative D would result in slightly more northern hardwood and hemlock forest types present on the ANF (see Table 2.3) placing more of the ANF at risk for decline and eventual mortality due to existing and imminent (looming) forest health concerns. Alternative Cm would result in the least amount of northern hardwood and hemlock forest types on the ANF in decade 6.

Acres of Allegheny hardwoods greater than 120 years old

The Allegheny hardwood forest type, dominated by black cherry, ash, and tulip poplar is shorter lived relative to other types on the ANF. It is a very unique forest type worldwide, and within the broader northern hardwood type of the Northeastern United States. Some uncertainty exists regarding the maximum life span for black cherry trees on the Allegheny Plateau (as opposed to the rotation age, which is based on culmination of mean annual growth increment, or financial maturity), and what age substantial loss of product value occurs. While Marquis (1990) suggests that beyond age 80 to 100 years, diameter growth slows and mortality of black cherry increases, others (Parker and Merritt 1995) recommended a rotation age of 70 to 90 years old for black cherry, with a maximum rotation age of 250 years old. More recent observations within the Tionesta Research Natural Area noted black cherry trees over 180 years old that outwardly appeared healthy and appeared to contain high value per U.S. Forest Service grade guidelines (Engelman et al. unpublished). The monitoring plan (table 16 of LRMP) includes a research question to investigate the longevity of the Allegheny hardwood type on the ANF. Presently 57 percent of the Allegheny hardwood type on the ANF is 81 to 100 years old (Table 3-20). Alternatives A, B, and Cm strive to maintain shorter-lived, shade-intolerant forest types present on the ANF through even-aged regeneration methods. This includes maintaining the Allegheny hardwood type, the vast majority of which is rapidly maturing on the ANF.

In order to assess the relative health of ANF vegetation with respect to age a second evaluation criterion is the amount of Allegheny hardwoods greater than 120 years present on the landscape in decade 6 of LRMP implementation. This age was selected as it is past the rotation ages recommended by Parker and Merritt (1995) for black cherry, and older than the age where Marquis suggested black cherry mortality starts to increase. Forest type changes take a number of years to occur, depending on disturbances to forest canopies and understory vegetation conditions (including presence or absence of interfering vegetation and tree seedling species), and therefore the relative abundance of Allegheny hardwoods on the ANF is not anticipated to greatly change in the next two decades. Determining when Allegheny hardwood can be expected to substantially decline in terms of seed production, value, and internal defect, and mortality has been identified as an LRMP research need (see table 16 in the monitoring section of the LRMP).

According to Table 2-3, Alternative B would result in the least amount of Allegheny hardwoods greater than 120 years in decade 6. This is because Alternative B focuses on balancing age class distribution, and regenerating Allegheny and upland hardwood forest types in the earlier decades of LRMP implementation. Alternative Cm, conversely, strives to better balance harvest among different forest types, therefore regenerating less Allegheny hardwoods than Alternative B and retaining more Allegheny hardwood stands that are older. Alternative A would result in the second largest amount of Allegheny hardwoods greater than 120 years old, closely followed by Cm Alternative D, which features greater use of uneven-aged management, would result in the largest acreage of Allegheny hardwoods greater than 120 years old, more than double the amount of Alternative B. This is because uneven-aged management tends to favor more shade-tolerant forest types such as northern hardwoods (Stout 1994, p. 330-333), and fewer Allegheny hardwoods would be regenerated with even-aged methods in this Alternative.

An ecological challenge within the context of forest health and sustainability is the lack of developed forest understories on the ANF, which has been impacted by a legacy of overbrowsing by deer for the past 70 years. This legacy of selective browsing by high deer populations has resulted in understories that are dominated by native invasive species such as ferns, grasses, striped maple, and beech, while desirable seedling regeneration, shrubs, and herbaceous vegetation is greatly reduced in abundance and diversity. Furthermore, stands with heavy mortality from the beech bark disease are often replaced by dense stands of susceptible beech sprouts that prevent the regeneration of other hardwood species (Latty *et al.* 2003). The degree to which each alternative treats forest understories on the ANF to enhance understory diversity, structure, and sustainability could also be considered a component of forest health. Alternative D would result in the least amount of annual reforestation treatments to treat interfering understory vegetation (see Table 2-2) and promote an abundance of diverse tree seedlings and herbaceous vegetation. This will be discussed in greater detail in the forest structure section of environmental consequences.

Forest vegetation management

Total acres treated by silvicultural system

Silvicultural and reforestation activities in all alternatives would be applied to achieve desired vegetative conditions. Even-aged management would be employed to sustain a diversity of structural and age classes on the landscape, while uneven-aged management would be applied to develop vertical structure and multi-aged stands, particularly in Alternatives B, Cm, and D. Reforestation treatments would be applied to sustain a diversity of tree species, and restore understory structure and diversity in areas impacted by a legacy of deer browsing impacts in all alternatives. Each alternative would utilize silvicultural techniques to varying degrees to meet desired vegetation conditions.

As can be seen in Table 3-32, both even-aged and uneven-aged regeneration treatments are proposed in all alternatives. The silvicultural systems used and amount of treatments are based on the desired vegetation conditions for each alternative, the allocation of management areas, and management area prescriptions. Alternatives A, B, Cm, D would all maintain some degree of both horizontal and vertical diversity, each uniquely to varying degrees, on portions of the ANF through proposed timber harvesting, reforestation, and wildlife habitat improvement activities. Most managed stands would have improved vigor and be more resilient to disturbance. Harvest of trees as a result of management activities would contribute to a sustainable flow of forest products from the ANF.

Alternatives A and B emphasize the use of even-aged silvicultural systems the most, adding more than 40,000 acres of early structural vegetation by the end of decade 2, which would increase horizontal diversity across the landscape. Alternative Cm also emphasizes the use of even-aged regeneration harvest, but includes greater use of uneven-aged management. Alternative A would result in the most even-aged regeneration treatments in decades 1 and 2 of implementation. Alternative D would result in the least amount of even-aged regeneration, with roughly one-third the level as Alternative A. Alternative D also features uneven-aged silviculture, and follows Alternatives B and Cm in the amount of uneven-aged regeneration occurring in decades 1 and 2, with uneven-aged regeneration treatments increasing in later decades.

Alternative A, which encompasses 1986 Forest Plan direction, includes two management area prescriptions not included in the other alternatives: MAs 6.2 and 9.1. MA 6.2 features even-aged silviculture in four areas on the ANF, with one scheduled for entry each decade and harvest activities in a given area limited to one decade every 40 years. It should be noted that one decade is not always allow enough time to develop sufficient seedlings in all forest types, particularly oak forest types. In Alternative A, the Hemlock Run MA 6.2 area on the Bradford Ranger District would be managed during the first decade of LRMP implementation. The vegetation in MA 9.1 features minimal investments only as needed to protect the environment or incidental forest user.

Table 3-32. Estimated acres (rounded to nearest 100) regenerated by silvicultural system and management area- decades 1 and 2

	Decade 1 Acres				Decade 2 Acres			
	Alt. A	Alt. B	Alt. Cm	Alt. D	Alt. A	Alt. B	Alt. Cm	Alt. D
Management Area	Acres of Even-aged Regeneration Harvest (Shelterwood Removal Cut and /or Clearcut)							
1.0	400	300	300	200	800	700	700	500
2.2	n/a ³	0	200	0	n/a ³	0	600	1,900
3.0	22,700	23,000	16,900	6,500	18,000	18,200	15,100	5,300
6.1	800	100	100	300	1,400	200	300	400
6.2	300	n/a ³	n/a ³	n/a ³	200	n/a ³	n/a ³	n/a ³
Total Even-aged Regeneration Harvest¹	24,200	23,400	17,500	7,000	20,400	19,100	16,700	8,100
Management Area	Acres of Uneven-aged Management							
2.1	100	n/a ³	500	500	0	n/a ³	500	500
2.2	n/a ³	4,000	6,200	2,500	n/a ³	3,300	2,700	2,500
Total Uneven-aged Management²	100	4,000	6,700	3,000	0	3,300	3,200	3,000

¹ Represents final harvested acreage. Acreage for shelterwood seed cuts are not displayed.

² Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

³ Management Area is not included in the Alternative considered.

MAs 1.0 and 3.0 feature shade-intolerant and mid-tolerant species such as black cherry, yellow poplar, white ash, aspen, and red maple, which thrive in full sunlight conditions. Even-aged regeneration methods utilized in these management areas feature forest types such as Allegheny and upland hardwoods, and oaks, which are comprised of primarily shade-intolerant or mid-tolerant vegetation. As can be seen in Table 3-32, in all alternatives, the bulk of even-aged management occurs in MA 3.0. Even-aged silviculture features these species presently occurring in these management areas, and would help maintain the hardwood communities found on the ANF today. Some uneven-aged management is anticipated to occur in MA 1.0 and 3.0 in order to meet site specific project needs such as meeting Scenic Integrity Objectives, enhancing riparian area structure, or providing wildlife habitat.

MA 6.1 features mature forest conditions sustained by even-aged management, and is mostly featured in Alternative A. Compared to MAs 1.0 and 3.0, even-aged management in MA 6.1 would be less intensive, on

longer rotations. Where even-aged management occurs in MA 6.1, shade-intolerant and mid-tolerant forest types such as oaks, aspen, pines, Allegheny hardwoods, and upland hardwoods would be maintained. Some upland and northern hardwood types dominated by intermediate and tolerant species such as sugar maple, American beech, eastern hemlock, red maple, birch, and cucumber would occur where uneven-aged management is applied, or where oak stands transition to red maple in the absence of forest management.

Alternatives B, Cm, and D all add MA 2.2, which would be managed to develop older, structurally-complex forests in a connected pattern across the landscape. Invasive understories would be treated and active vegetation management applied in portions of MA 2.2 to accelerate development and restoration of late structural characteristics consistent with natural disturbance regimes, address impacts of introduced pests such as the beech bark disease complex, and control species composition. Other portions of MA 2.2 would be more passively managed, influenced by natural changes and the effects of native and introduced invasive vegetation, insects, and diseases. Uneven-aged management would be actively applied in MAs 2.1 and 2.2, which would feature shade-tolerant species such as sugar maple, American beech, and eastern hemlock that do well under shaded conditions, and species that are intermediate in shade tolerance such as red maple, birch, and cucumber where group selection occurs. A small amount of even-aged management would occur less intensively and on longer rotations in MA 2.2 to sustain an early structural component in shade-intolerant types (4-6% in oak types; 2-4% in other forest types). Traditional even-aged management would be applied in oak, aspen, and white pine, while two-aged or uneven-aged management would be applied in other forest types within MA 2.2. Due to the present lack of access, it is projected that roughly one-half of MA 2.2 would be passively managed, and eventually be comprised of upland and northern hardwood forest types that are dominated by shade-tolerant or intermediate species such as sugar maple, American beech, eastern hemlock, birch, and red maple. MA 2.1 permits even-aged management in order to maintain short-lived shade-intolerant forest types such as aspen.

MAs 6.3 and 8.4 would be managed for a mix of structural stages, with a large proportion consisting of permanent grasslands.

Management areas such as 7.1, 7.2, 7.3, and 8.1, where little vegetation management would occur, or MAs 5.1, 5.2, 8.2, 8.3 and 8.5, where no vegetation management would occur, would be primarily influenced by natural succession, favoring shade-tolerant northern hardwood vegetation and deer browse-resistant vegetation such as American beech over time. Where oak predominates in essentially unmanaged areas, such as MA 8.1 (Wild and Scenic River corridor), 7.2 (Remote Recreation Areas), and 8.2 (National Recreation Area) vegetation is anticipated to slowly transition over the long term from oak to red maple dominance. MA 8.6 would permit vegetation management for research purposes only and could feature either shade-intolerant or tolerant vegetation depending on the treatments applied.

Table 3-33 displays the estimated cumulative acres by Management Area that would be regenerated on ANF lands by silvicultural system through decade 6 of LRMP implementation in each of the Alternatives. These activities would create a mix of age-classes, which is emphasized more strongly in Alternatives A, B, and Cm. Most managed stands would have improved vigor and be more resilient to disturbance. Cumulatively, harvest of trees as a result of management activities would contribute to a sustainable flow of forest products from the ANF as well as private and other public lands in the CE area.

Alternatives A, B, and Cm emphasize the use of even-aged silvicultural systems which tends to increase horizontal diversity across the landscape, whereas Alternative D places greater emphasis on the use of uneven-aged systems that promote vertical diversity within treated areas. Alternative A would result in the most even-aged regeneration and the least amount of uneven-aged regeneration treatments through decade 6 of implementation. Conversely, Alternative D would result in the least amount of even-aged regeneration. By decade 6 of implementation, Alternative D results in the largest land area on the ANF managed using uneven-aged silviculture, more than three times the amount of Alternatives B or Cm. The vast majority of uneven-aged regeneration treatments in Alternative D would occur in MA 2.1. Of all the regeneration treatments applied in Alternative D, more than half would occur through uneven-aged regeneration methods.

Table 3-33. Estimated cumulative acres (thousands of acres) regenerated on the ANF by silvicultural system and management area- decades 1 through 6

Decades 1-6 Acres (thousands)				
	Alt. A	Alt. B	Alt. Cm	Alt. D
Management Area	Acres (thousands) of Even-aged Regeneration Harvest (Shelterwood Removal Cut or Clearcut)			
1.0	3.2	3.0	3.0	1.7
2.2	n/a ³	2.3	3.2	3.6
3.0	121.2	123.6	102.4	27.9
6.1	11.6	1.3	1.7	3.1
6.2	3.6	n/a ³	n/a ³	n/a ³
Total Even-aged Regeneration Harvest¹	139.6	130.2	110.3	36.3
Management Area	Acres (thousands) of Uneven-aged Management			
2.1	0.1	n/a ³	1.0	40.6
2.2	n/a ³	13.8	16.1	10.0
Total Uneven-aged Management²	0.1	13.8	17.1	50.6

¹ Represents final harvested acreage. Acreage for shelterwood seed cuts are not displayed.

² Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

³ Management Area is not included in the Alternative considered.

In total, Alternative B would regenerate the most acres using either even-aged or uneven-aged methods to achieve desired vegetation conditions, followed closely by Alternative A. Alternative D, on the other hand, would regenerate the least amount of land area by decade 6 of implementation using either method to achieve the desired vegetation conditions of this alternative.

It should be noted that several concerns exist regarding the use of uneven-aged management on the ANF, particularly in the long term. As summarized by Nyland (2003), though attractive on the surface, conversion of even-aged forest communities to uneven-aged will take a century-long period and has some real costs, including:

- a shift of composition towards more shade-tolerant species;

- a decrease in some commodity benefits through time;
- a need to change traditional harvesting methods and equipment;
- a loss or decrease of some historic non-market values in converted stands;
- a change of habitat for some plants and animals.

Uncertainty with reforestation has been associated with uneven-aged management on the ANF (USDA FS 1998, pp. 18 and 86; USDA FS 2001d pp.16, 17, 76, 77; USDA FS 2002, p.23; Stout 1994, pp. 333-334). In addition, substantial concerns exist about the use of uneven-aged management that features strictly shade-tolerant species such as beech, sugar maple and hemlock which all presently face serious forest health threats. However new standards and guidelines for the use of uneven-aged management should reduce the uncertainty and forest health concerns associated with uneven-aged management on the ANF, and increase its long-term successfulness. These guidelines include allowing for larger opening sizes, with the intent of regenerating a greater diversity of tree species, including shade-intolerant (e.g. black cherry, yellow poplar, ash, northern red oak) and mid-tolerant (e.g. red maple, birch, cucumber) species than would occur under current standards for uneven-aged management. Deer browsing impacts on seedling regeneration in the past has reduced the potential successfulness of uneven-aged regeneration methods. In recent years, however, browsing intensity has decreased on the ANF as a result of implementation of new deer management options created by the Pennsylvania Game Commission, but understory response lags behind the deer population drop (deCalesta 2005). If current programs remain in effect, it is possible that one of the most important challenges to regeneration success on the ANF will be eased during the implementation period for this plan, but it is also possible that deer impacts will return to historic and challenging levels. A future with reduced deer impact may reduce the need for fencing and some of the barriers to successful implementation of uneven-aged silviculture. However, in most cases existing interfering vegetation will still need treatment, regardless of future deer populations. It is assumed that deer populations will remain at presently reduced levels during the planning period, increasing the potential successfulness of uneven-aged management in the future on the ANF. Some uncertainty exists, however, regarding future deer populations on the ANF. Alternative D would employ the greatest amount of uneven-aged management, and regenerate the fewest acres in the long term. The overall lack of harvesting, particularly regeneration treatments, would likely result in decreased browse availability on the landscape and consequently increased deer browsing impacts to understory vegetation in Alternative D. Therefore, Alternative D has the greatest amount of uncertainty associated with forest vegetation outcomes.

Total harvest and reforestation acres

Table 2-2 displays projected average annual management activities by alternative estimated for decade 1 and decade 2 of LRMP implementation. The following discussion compares relative differences in average annual activity amounts anticipated by alternative, and is based on the amounts displayed in this table.

Harvest activities

Alternatives A (2,043 to 2,423 acres annually) and B (1,917 to 2,341 acres annually) would result in similar even-aged regeneration harvest levels, and Alternative Cm would result in 1,673 to 1,754 acres of even-aged regeneration harvests. Alternatives A, B and Cm all project higher than average levels of even-aged regeneration harvesting that have occurred on the ANF for the past 20 years. It should be noted that harvest levels, and associated reforestation treatments have been

lower than the levels predicted in the 1986 Forest Plan, particularly during the past decade. The 1986 Forest Plan projected accomplishments for each type of harvest activity (acres) necessary to achieve the desired future forest condition and the maximum allowable sale quantity for each decade (94.5 MMBF per year). The Analysis of Timber Harvest Program Capability completed in 1995 (USDA FS, 1995a) projected a maximum annual harvest of 53.2 MMBF per year for 1995-2005. The total final harvest acreage for 1986-2005 is only 43 percent of the 1986 Forest Plan maximum projection for 1986-2005, and it is 86 percent of the revised projection made in the 1995 Analysis of Timber Harvest Program Capability (THPC). Actual thinning acreage accomplished is 30 percent of the 1986 Forest Plan level and 81 percent of the THPC level. Selection harvesting is 102 percent of 1986 Forest Plan or THPC level, while shelterwood seed harvests are 32 percent of the 1986 Forest Plan projection and 64 percent of the THPC projection.

Alternative D would result in roughly one-third to one-half the amount (699 to 812 acres annually) of even-aged regeneration as the other alternatives. In all four alternatives of the LRMP, even-aged thinning is projected to be less than that which occurred on the ANF in the past 20 years, with Alternative D thinning the least amount (195 to 317 acres) annually, and Alternative A thinning the most (1,149 to 1,363 acres).

Similar levels of vegetation management to enhance riparian vegetation would occur in Alternatives A, B, and Cm (92 to 107 acres annually), with lower levels occurring in Alternative D (61 to 64 acres annually). Alternative Cm would result in the greatest amount (320 to 666 acres annually) of uneven-aged management in decades 1 and 2, followed by Alternative B (326 to 403 acres annually). Alternative A would utilize the least amount (0 to 6 acres annually) of uneven-aged management.

Reforestation treatments

ANF personnel have successfully reforested 96 percent of the acres final harvested (even-aged management) between 1976 and 2001. However, the majority of these areas have been in the Allegheny hardwood forest type. There is less certainty about the reforestation treatments (type, timing, length of time for seedling development, and sequence) necessary to achieve desired reforestation success (both tree species diversity and tree species abundance) in other forest types (northern hardwood, upland hardwood, oaks, etc.). In the past 30 years, much has been learned about reforestation techniques that will foster greater seedling species diversity in all forest types on the ANF, including greater use of release, soil scarification, and the use of controlled burning in fire-adapted forest types such as oaks. These improved reforestation techniques are incorporated into the LRMP in order to foster successful regeneration of a broader array of tree species in all forest types.

Associated reforestation activities necessary to successfully regenerate each treated forest type in each alternative were predicted during the SPECTRUM modeling, and are summarized below. All alternatives would result in a substantial increase in reforestation activities applied annually on the ANF over those applied in the past two decades- in many cases double the amount. These activities would be applied to ensure regeneration of well stocked, diverse forested areas, in order

to maintain diverse, healthy forested ecosystems into the future. In general, Alternatives A, B and Cm would implement the most reforestation treatments to regenerate a diversity of tree species, while Alternative D would utilize the least amount of reforestation treatments.

Area fencing exclosures to limit deer browsing on desired tree seedlings have become the most reliable reforestation technique to help assure greater vegetative diversity, and therefore better success in regenerating more challenging tree species. Estimated future area fencing ranges from 501 acres annually in Alternative D to 1,701 acres annually in Alternative Cm. Alternatives A, B, and Cm project higher levels of fencing than the amount that has occurred annually on the ANF for the past 20 years (735 acres). These are the anticipated acreages that would require fencing to meet silvicultural objectives for each alternative under current deer browsing impact levels. In recent years, deer populations have dropped on the ANF. In all of the alternatives, there is some uncertainty concerning the need for future fencing, particularly in Alternative D where substantially less harvesting would occur (Deer impact is a joint function of deer density and forage availability [deCalesta and Stout 1997]). Deer populations can quickly rebound if less deer harvesting would occur in the future. Should deer populations remain at this level or lower, it is possible that the need to fence areas could decline in the future, particularly where harvest activities are concentrated within a geographic area.

In response to new science, future use of fertilizer will be reduced to minimize reduction of soil base cations on plateau and upper sideslope sites, and also to enhance tree seedling diversity through other methods such as fencing (see LRMP guidelines). The average annual amount of fertilization for the past 20 years has been nearly 800 acres on the ANF, though acres fertilized has decreased in recent years. Alternatives A and B would result in the most annual fertilization (343-388 acres), and Alternative D the least (87-98 acres), with less than one-third that amount.

Though browsing intensity by deer has recently declined, interfering understories that are well established as a result of a legacy of deer browsing impacts will still need treatment to encourage a diversity of tree seedlings and herbaceous vegetation to become established. With continued use of the DMAP program, improvements in understory health and diversity should be evident with time. However, control of undesired interfering vegetation with herbicides currently remains the only cost effective option to prepare understories for seedling development and creation of early structural (age) forest classes. Increasing the types of treatment techniques available (e.g. more selective methods) will help to regenerate more difficult species (e.g. oaks) by selectively controlling interfering vegetation while allowing diverse seedling regeneration to become well established and competitive. Alternative A would utilize broadcast and manual foliar application methods only, whereas target-specific cut surface (cut and frill, injection, and cut stump) methods are added as treatment options in Alternatives B, Cm, and D. These application methods, along with new buffer zone widths along water courses (see LRMP standards and guidelines), would allow for treatment of interfering understory vegetation in riparian areas in Alternatives, B, Cm and D. Alternative A would utilize the same buffer widths along water courses that are presently used, which excludes any necessary treatment of interfering vegetation in riparian areas.

Alternatives A, B, and Cm would result in herbicide application levels higher than those actually applied on the ANF in the past 20 years (977 acres annually). Alternative D would result in the least amount (756 to 931 acres annually) of herbicide application to treat interfering understory vegetation, and Alternative Cm proposes the most (1,631 to 2,368 acres annually) in decades 1 and 2. In Alternatives A, B, and Cm, site preparation, another technique to remove interfering woody vegetation, would increase over levels that have occurred on the ANF for the past 20 years (1,385 acres annually). Alternative Cm projects the highest level (1,658 to 1,992 acres annually) of site preparation, while Alternative D would result in the least amount (631 to 865 acres annually).

Alternative Cm would result in the most herbicide application for regeneration purposes (39,900 acres) by the end of the second decade of LRMP implementation, while Alternative D would result in the least (16,870 acres). This would result in a reduction of fern, striped maple, beech brush, other interfering hardwoods, and grasses, cumulatively increasing the tree seedlings and a diversity of other herbaceous understory species. Upon successful establishment of seedlings on these acres, overstory trees would be harvested (future foreseeable action) through even-aged or uneven-aged methods, and in most cases new stands of trees would result (future foreseeable action). Even-aged regeneration harvesting would occur on 15,100 acres (Alternative D) to 44,600 acres (Alternative A) during the first two decades of implementation. The indirect effect would be a substantial change in age class distribution. Uneven-aged harvesting would remove primarily groups of trees on 60 acres (Alternative A) to 9,860 acres (Alternative Cm) during the first two decades.

Prescribed burning and mechanical scarification are relatively new techniques on the ANF, and a minimal amount has occurred on the ANF in the past 20 years. Increased levels of prescribed burning and mechanical scarification of oak seedbeds are incorporated to promote oak regeneration. New science indicates the shelterwood burn technique would be more effective in maintaining the oak types on the ANF than past methods (see Appendix A of the LRMP, Vegetation Management Practices- Rationale for Choice). Alternatives B and Cm would result in the most (99 to 109 acres annually) prescribed burning for the purpose of regenerating tree seedlings, and Alternative D the least (8 acres annually). Likewise, Alternatives B and Cm would result in the most scarification to prepare seedbeds for seedling establishment (99 to 109 acres annually), and Alternative D the least (8 acres annually).

Release is a relatively new technique (since 1995) applied on the ANF in regenerating stands in order to maintain tree species diversity. The LRMP incorporates greater use of release treatments to improve tree species diversity in young stands. All alternatives would result in increased levels of release to maintain tree species diversity over average levels applied on the ANF for the past 20 years (531 acres annually). Alternative Cm incorporates the greatest use of release to promote tree species diversity (1,727 to 2,271 acres annually), whereas Alternative D proposes the least (774 to 1,042 acres annually).

Harvest and reforestation activities by decade 6

The following table displays the cumulative intermediate thinning and regeneration harvests, and reforestation treatments estimated as needed to achieve the desired conditions for each alternative through decade 6. As can be seen from Table 3-34, Alternative A, followed closely by Alternative B would result in the most even-aged regeneration and thinning activity on the ANF, while Alternative D would implement substantially less of these activities over the next 6 decades. Conversely, Alternative A would utilize the least uneven-aged management, whereas Alternative

Table 3-34. Estimated cumulative reforestation and regenerated acres (thousands of acres) on the ANF by silvicultural system - decades 1 through 6

	Decades 1-6 Acres			
	Alt. A	Alt. B	Alt. Cm	Alt. D
Treatment	Acres (thousands) of Harvest Activity			
Intermediate Thinning	76.0	54.4	40.7	10.7
Even-aged Regeneration ¹	139.6	130.2	110.3	36.3
Uneven-aged Management ²	0.1	13.8	17.1	50.6
Treatment	Acres (thousands) of Reforestation Activity			
Site Preparation	126.9	134.9	118.3	76.5
Herbicide Application	122.3	132.3	118.3	78.4
Fencing	111.5	118.7	104.7	69.9
Prescribed Burning	5.7	8.4	7.7	2.4
Scarification	5.7	8.4	7.7	2.5
Fertilization	11.2	12.3	10.7	5.3
Release	144.0	145.9	137.5	83.5

¹ Represents final harvested acreage. Acreage for shelterwood seed cuts are not displayed.

² Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

D would implement far more uneven-aged regeneration treatments than any of the other alternatives. Alternatives A and B would implement similar levels of herbicide application and site preparation to treat invasive, interfering understory vegetation in order for diverse tree seedling regeneration to become established, while a lesser amount is projected for Alternative Cm by the end of decade 6. Alternative D would implement roughly 2/3 the amount of herbicide application and site preparation as the other alternatives. Much of this would occur in Alternative D every 20 to 40 years in conjunction with overstory treatments.

Alternative B would utilize the most fencing in the next 6 decades, while Alternative D would utilize the least amount. Most of the fencing in Alternative D is for seedling development under an uneven-aged system, where shade would reduce seedling height growth and fences would likely need to be in place longer than under an even-aged system. Additionally, lower overall forage created and maintained by vegetation management in Alternative D, will result in greater impacts from deer browsing. In all of the alternatives, there is some uncertainty concerning the need for future fencing, particularly in Alternative D where substantially less harvesting would occur. The figures shown in Table 3-35 are the anticipated acreages that would require fencing to meet silvicultural objectives for each alternative under current deer browsing impact levels. Should deer

populations remain at present levels or lower, it is possible that the need to fence areas could decline in the future, particularly where harvest activities are concentrated within a geographic area.

Alternatives B and Cm would implement the most prescribed burning and scarification to regenerate oak forests, while Alternative D would result in far less during the next 6 decades. Alternatives A, B, and Cm would result in similar levels of fertilizer application, while Alternative D would fertilize less than half the acreage of the other alternatives over the next 6 decades. Alternative D would complete release to promote species diversity on the fewest acres (just over 50% of the other alternatives), while Alternatives A and B would release similar amounts of acreages. Alternative Cm would release less acreage than Alternatives A and B. In summary, Alternatives A and B would do the most to create greater age class diversity on the ANF, and treat the most interfering vegetation, followed by Alternative Cm.

Total acres regenerated by forest type and silvicultural system

Table 3-35 displays the estimated acreage by forest type that would be regenerated through even-aged and uneven-aged methods in each of the alternatives during decades 1 and 2 of LRMP implementation. Alternatives A and B would regenerate the most Allegheny hardwoods using even-aged management. All alternatives, particularly A and B would regenerate more Allegheny hardwoods in the first two decades of LRMP implementation, as this forest type is considered shorter lived relative to most other forest types found on the ANF. Even-aged management best maintains Allegheny hardwoods (Bjorkbom and Walters 1986). These alternatives would regenerate other forest types more in subsequent decades of LRMP implementation. Even-aged management best maintains upland hardwoods and oaks as well (see Appendix A to LRMP, Vegetation Management Practices – Rationale for Choice). Alternative Cm strives to balance harvest activities more evenly across all forest types.

Alternatives B, Cm, and D use more uneven-aged systems that would promote vertical diversity over the long term (see cumulative effects section) than Alternative A. The majority of uneven-aged management applied in Alternatives B and Cm would be applied to help meet desired conditions for late structural vegetation in MA 2.2. These forest types would transition towards upland hardwoods, with an abundance of species that are intermediately tolerant of shade, assuming a group selection system would generally be used. As shown in Table 3-35, most uneven-aged treatments would occur in upland and Allegheny hardwoods.

Table 3-36 displays the estimated cumulative acreage by forest types that would be regenerated on ANF lands through even-aged and uneven-aged methods in each of the alternatives through decade 6 of LRMP implementation. Alternatives A and B would regenerate the most Allegheny and upland hardwoods using even-aged management, and Alternative D the least amount. Alternatives A and B would also regenerate the most oaks through even-aged management by decade 6 of implementation, and Alternative D the least. Alternatives A, B, and Cm would best maintain the shade-intolerant Allegheny, upland, and oak hardwood forest types present on the ANF today. Alternative Cm would regenerate the most northern hardwoods through even-aged management. Northern hardwoods regenerated through even-aged management will have a

greater shade-intolerant or intermediate component and shift towards upland hardwood forest types. Efforts will be made to sustain the aspen type on the ANF through commercial or noncommercial treatments that will be identified at the project level. Additionally, efforts will be made to sustain or increase the aspen present as a component of forest stands not typed as aspen as a whole.

Alternative D places greater emphasis on the use of uneven-aged systems to meet desired conditions of providing more late structural, older forest vegetation with greater continuous forest canopy over the long term. As shown in Table 3-36, most uneven-aged management would occur in upland and Allegheny hardwoods in all of the alternatives, with D regenerating a greater variety of forest types using uneven-aged regeneration methods. Allegheny and northern hardwoods would transition towards upland hardwoods under a group selection system, with an abundance of species that are intermediately tolerant of shade, and towards northern hardwoods under single tree selection. Oaks regenerated through uneven-aged methods would result in less abundant oak trees in treated areas, with a greater abundance of species more intermediate in shade tolerance, such as red maple and birches.

Table 3-35. Estimated acres (rounded to nearest 100) regenerated by silvicultural system and forest type - decades 1 and 2

	Decade 1 Acres				Decade 2 Acres			
	Alt. A	Alt. B	Alt. Cm	Alt. D	Alt. A	Alt. B	Alt. Cm	Alt. D
Forest Type	Acres of Even-aged Regeneration Harvest (Shelterwood Removal Cut or Clearcut)							
Upland hardwood	2,500	2,200	2,100	600	1,200	300	3,700	300
Allegheny Hardwood	21,500	20,200	13,500	6,200	19,200	18,800	10,300	4,000
Oaks	100	0	0	0	0	0	0	400
Northern Hardwood	100	1,000	900	200	0	0	1,700	0
Mixed (Low stocked)	0	0	1,000	0	0	0	1,000	3,400
Aspen	n/a ¹	n/a ¹	n/a ¹	n/a ¹	n/a ¹	n/a ¹	n/a ¹	n/a ¹
Total Even-aged Regeneration Harvest²	24,200	23,400	17,500	7,000	20,400	19,100	16,700	8,100
Forest Type	Uneven-aged Management							
Upland hardwood	0	1,000	1,400	1,000	0	1,000	1,400	1,000
Allegheny Hardwood	100	2,300	4,400	1,200	0	1,500	900	1,200
Oaks	0	0	0	0	0	0	0	0
Northern Hardwood	0	700	900	800	0	800	900	800
Total Uneven-aged Management³	100	4,000	6,700	3,000	0	3,300	3,200	3,000

¹ Aspen will be sustained through commercial or noncommercial methods to be determined at the project level.

² Represents final harvested acreage. Acreage for shelterwood seed cuts are not displayed.

³ Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

Table 3-36. Estimated cumulative acres (thousands of acres) regenerated by silvicultural system and forest type -- decades 1 through 6

	Decades 1-6 Acres			
	Alt. A	Alt. B	Alt. Cm	Alt. D
Forest Type	Acres (thousands) of Even-aged Regeneration Harvest (Shelterwood Removal Cut or Clearcut)			
Upland hardwood	70.5	55.9	34.6	6.0
Allegheny Hardwood	59.4	62.5	53.5	23.8
Oaks	7.0	10.5	9.9	2.2
Northern Hardwood	2.5	1.2	10.3	0.9
Mixed (Low stocked)	0	0	2.0	3.4
Aspen	0.2	0.1	n/a ¹	n/a ¹
Total Even-aged Regeneration Harvest²	139.6	130.2	110.3	36.3
Forest Type	Acres (thousands) of Uneven-aged Management			
Upland hardwood	0	4.0	5.2	23.1
Allegheny Hardwood	0.1	6.8	8.7	14.7
Oaks	0	0	0	1.6
Northern Hardwood	0	3.0	3.2	11.2
Total Uneven-aged Management³	0.1	13.8	17.1	50.6

¹ Aspen will be sustained through commercial or noncommercial methods to be determined at the project level.

² Represents final harvested acreage. Acreage for shelterwood seed cuts are not displayed.

³ Represents acreage that receives a first entry harvest under an uneven-aged system. This can represent an improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

Cumulative effects

Scope of analysis

The vegetation cumulative effects discussion assesses the combined effects from past, present, and "future foreseeable" actions from activities on Federal and non-Federal land in the four county area surrounding the ANF.

"Future foreseeable actions" in this instance are those actions which might reasonably be expected to occur on private land or those which reasonably might be expected to occur in the future from past, present, or future ANF decisions.

The affected area for cumulative effects on vegetation is forest lands in the four counties that have ANF lands located within them. In some discussions a State-wide context is used to highlight differences from the four-county area. ANF personnel considered using the northern unglaciated Allegheny Plateau (Subsection 212Ga) for the cumulative effects area, but data was less available for that area than the four counties surrounding the ANF. Forest lands constitute approximately 84 percent of the entire land area in the four county region, with the

remaining 16 percent consisting of non forest land (cropland, pasture, water). Forest land in the four county region (Elk, Forest, McKean, and Warren counties) that includes the ANF is generally representative of vegetation conditions occurring on the ANF and the immediately surrounding area. According to 2004 FIA data, the forest lands in the four counties around the ANF are similar in species composition and age to the ANF, though they vary somewhat in size and stocking. Effects on forest health, forest composition, and forest age and stocking are analyzed in the context of treatments and management intensity.

The cumulative effect of vegetative management activities will be evaluated by totaling past ANF treatments in the last two decades (since implementation of the 1986 Forest Plan), estimated treatments on private and other public lands in the past two decades, anticipated ANF treatments under each alternative, and anticipated future treatments on private and public lands for the next twenty years based on past and anticipated future trends. This would incorporate completed and ongoing activities since approval of the 1986 Forest Plan. A time frame of 20 years into the future was used to evaluate ANF, private, and other public land management activities in the cumulative effects analysis area, as this would allow time for much of the anticipated ANF management activity to be implemented, resulting vegetative changes to occur, and is a realistic time frame to predict reasonably foreseeable actions from this planning cycle.

Introduction

The primary effects on vegetation will occur from proposed commercial timber harvest, reforestation treatments, non-commercial treatments, wildlife habitat improvement work, activities that convert forest to non-forested land, past and future development, and from doing no treatment at all on a site (allow other influences and natural processes to continue). These activities can result in changes in understory and overstory conditions, forest structure, age of forested areas, and changes in plant species composition and diversity.

Other influences on forest vegetation in the cumulative effects analysis area will continue to varying degrees, across all alternatives. These include the effects of beech bark disease, atmospheric deposition (acid rain), deer browsing impacts, natural disturbances, and threats to forest health. These will be discussed in further detail in the following cumulative effects section. Lands within the cumulative effects area for vegetation are categorized by ownership (Table 3-37). The cumulative effects analysis area totals slightly more than 1.7 million acres of forest lands, of which, ANF lands comprise 29 percent. Other public lands comprise 14 percent, and the remaining 57 percent of the cumulative effects analysis area consists of private lands.

Table 3-37. Forest land¹ ownership within four county cumulative effects area

Ownership Class	Four-County Area (1,000 acres, %)
National Forest	496.7 (29)
Other Public	248.9 (14)
Total Public	745.6 (43)
Private Industrial	51.7 (3)
Private Non-industrial	946.2 (54)
Total Private	997.9 (57)
Total All Ownership Classes	1,743,500

¹ Total acres classified as forest land by 2004 FIA data (Alerich *pers. comm.* 2006)

Cumulative effects common to all alternatives

The following discussion describes effects and influences on forest vegetation that are anticipated to occur in the cumulative effects analysis area regardless of the alternative selected. It is divided into two broad sections: oil and gas development and cumulative effects where forest vegetation management will not occur.

Oil and gas development

Past oil and gas development

Oil and gas development is assumed to be constant across the alternatives evaluated, and is based on the analysis provided in Appendix F of this document. Approximately 93 percent of the minerals underneath the ANF are privately owned. Assuming that each oil and gas well site, along with associated access roads, results in an average of 1.3 acres of disturbance (well pad and access road) and the average annual amount of disturbance between 1986 and 2005 was about 225 wells per year, an estimated 5,800 acres of disturbance occurred during the past 20 years. Generally this disturbance has the effect of converting a forested area to non-forested or non-vegetated condition where access roads and well pads are located. There are presently approximately 8,000 oil and gas wells, along with an estimated 1,250 miles of associated access roads on the ANF. It is estimated that oil and gas clearing (including associated roads) currently occupy 1.4 percent of the ANF land base.

Assuming oil and gas development levels are similar on other public and private lands in the four county cumulative effects analysis area, it is estimated there are now about 28,000 wells, and that oil and gas clearing (including roads) occupies 1.4 percent of the entire cumulative effects landbase (includes ANF lands).

Close well spacings of 400 to 500 feet are frequently used on areas of the ANF that contain oil and gas reserves. This equates to one well drilled per five acres of land. Oil and gas wells, associated access road construction, facilities, and powerlines have the indirect effect of increasing operational costs for activities such as reforestation treatments, and reducing the efficiency of managing forested ecosystems, as blocks of contiguous, uniform forest vegetation are reduced in size where dense networks of roads exist. Since the amount and location of development is unpredictable, the potential impact to plant and animal communities is difficult to quantify. However, in general, as the density of wells and roads increase, ecosystem integrity decreases.

Future oil and gas development

For the purposes of the following cumulative effects analysis, a future development rate of 512 wells per year (see Table 2-4), or an additional 666 acres annually converted to non-forest land on the ANF will be assumed for the next 20 years. Assumptions used in Table 2-4 to the mid-point of the second decade were extended to 2025 for this analysis. Beyond that, oil and gas development is difficult to predict due to changing markets and demand, and factors such as changes in drilling technology. Using this annual average, it is anticipated over 18,000 wells could exist on the ANF by the year 2025, occupying about 4 percent of the ANF land base.

Presently, an estimated 28,000 wells exist within the entire four-county cumulative effects analysis area (including ANF, State, and private lands). By applying the same anticipated future oil and gas development rates to the surrounding four county area, it is estimated a total of nearly 63,000 wells could exist in the entire cumulative effects analysis area (includes ANF, State and private lands) by the year 2025. This would result in nearly 5 percent of the total cumulative effects analysis area consisting of non-forested lands from oil and gas development. Areas developed for roads associated with oil and gas activities on private and other publicly owned lands will not vary by alternative.

Should Federal minerals become developed on the ANF in the future, the effects to forest vegetation would be similar to those from private oil and gas developments.

Cumulative effects where forest management will not occur

Forest type transitions are anticipated to occur in each of the alternatives on ANF, State, and privately owned lands in the cumulative effects analysis area, particularly unmanaged areas and areas where reforestation investments are not made to sustain existing forest types. These changes are expected to occur over a number of decades.

Northern hardwoods and hemlocks

Northern hardwood stands with a large beech component in the cumulative effects area will continue to suffer beech bark disease mortality, and associated understory response of increased beech sprouting. The end result in unmanaged stands is a transition from high canopy overstory beech trees, to dense thickets of young root-sprout origin beech trees that are also susceptible to the disease complex as described by Latty *et al.* (2003). As previously discussed, if the hemlock woolly adelgid impacts hemlock stands on the ANF and surrounding four-county area, causing widespread hemlock mortality, these areas will convert to hardwood forest types, most likely upland hardwoods in the absence of management.

Upland hardwoods

Upland hardwoods will likely increase in their abundance on the ANF and surrounding four county area in all of the alternatives. Red maple, birches, and black cherry are primary components of upland hardwoods, but most unmanaged areas that transition to upland hardwoods will be dominated by birch species. As mentioned previously, sweet birch has been increasing in abundance in recent years on the ANF as deer browsing impacts have declined. Birches in the ANF region are often affected by *nectria* fungus and develop cankers in the main stem. The canker usually substantially reduces the commercial value of the trees and often results in mechanical failure (breakage) of the stem by age 60.

Allegheny hardwoods

The Allegheny hardwood type is unique to this part of the world (Marquis 1975, 1990). This forest type is a distinct subtype of the far more common northern hardwood or beech-birch-maple forest that spans the entire northern portion of the Eastern U.S. from New England to the Lake

States. Using FIA forest type classification, the ANF contains 19 percent black cherry forest types, compared to 17 percent in the surrounding four county area, and 7 percent Statewide. In fact, black cherry forest types comprise only 2 percent of forest land in the entire Northeastern United States (Morin *pers. comm.* 2005). Allegheny hardwoods occur on a relatively small portion of the northern hardwood distribution, primarily occurring on the Allegheny Plateau in Pennsylvania and New York, with smaller amounts in West Virginia.

According to 2004 FIA data, black cherry is the second most common tree species greater than 1” in diameter on the ANF (17%), similar to the surrounding four county area (15%) (Alerich *pers. comm.* 2006). Allegheny hardwoods, which typically have a large black cherry component, are shorter lived relative to other forest types. Each alternative would result in a different amount of Allegheny hardwoods being maintained across the landscape. In the long term, Alternative B would sustain the most Allegheny hardwoods on ANF lands, primarily through even-aged management, closely followed by Alternative A then Cm. Alternative D would sustain the least Allegheny hardwoods on the landscape.

Beyond age 80 or 100 years, diameter growth slows and mortality of black cherry increases rapidly (Marquis 1990). In the long term it is anticipated that unmanaged Allegheny hardwood stands, as they experience increasing mortality due to senescence, will slowly transition to upland hardwood, though they will most likely retain a substantial black cherry component.

Oaks

As mentioned previously, oak recruitment has nearly ceased in the past 50-100 years in much of the eastern U.S. on all but the driest and nutrient-poor sites (Abrams 2003, 2005). Partial overstory removals and the exclusion of fire have favored the development of shade tolerant species that limit the establishment, growth, and survival of oaks, and the continued dominance of oaks in eastern forests appears unlikely without intensive management (Gould *et al.* 2005). In the absence of frequent, low-intensity fires set by Native Americans over the past several thousand years, oak forest types along the Allegheny River and its major tributaries are slowly transitioning to understories and forests that will be dominated by red maple and birch.

Oaks and hickories range from intolerant to moderately tolerant of shade (Sander *et al.* 1983, p. 116), and therefore oak seedlings do not exhibit long-term survival or growth under closed canopy conditions (Abrams 1992). However, many associated trees, such as the maples and beech, are more tolerant of shade than oaks. Consequently, if undisturbed, oak stands on the ANF and surrounding four-county area will transition to shade-tolerant species.

The leaf litter of species that are presently replacing oaks is less flammable and decomposes more rapidly than that of upland oaks, rendering them less combustible in the future for those who wish to restore natural fire regimes (Abrams 2005). This is exacerbated by large deer populations that eat acorns, preferentially browse oak seedlings, and indirectly affect understory flammability by reducing leaf litter from understory vegetation.

Recent forest health monitoring completed in oak stands on the ANF found red maple to be the most abundant seedling species, followed closely by American beech. This virtual absence of oak regeneration indicates that oak-dominated stands may transition to stands dominated by other species unless steps are taken to ensure its inclusion (Morin *et al.* 2006). In the long term, unmanaged oak forest on the ANF is anticipated to transition to red maple and upland hardwoods.

Oak forests in the cumulative effects area, including the ANF, will likely transition to other forest types with far fewer oaks where no action is taken to open forest overstory canopies, reduce deer browsing impacts, or help oak seedlings gain a stronger competitive position through the use of fire, as has been observed in much of the eastern North America (Abrams 2003, 2005).

Additionally, the trend towards increases in non-oak tree species (red maple, American beech, birch, other hardwoods) will continue in oak forests that lack understory fire disturbances. The sustainability of the oak forest type is in question where no activities will occur to promote development of oak seedling regeneration. This concern is greatest in Alternative D where the largest acreage (63%) of oak types on the ANF is allocated to management area prescriptions that exclude active management of forest vegetation, and the least in Alternative A where the largest acreage (77%) of oak types is available for active management to promote conservation of oak forests on the ANF.

Cumulative effects on key vegetation elements from each alternative

The following elements will be used to discuss the potential cumulative effects to forest vegetation under each alternative based on past and anticipated levels of management activities that could have effects on vegetative composition, structure, forest health, and vegetation management activities necessary to meet the desired forest vegetative condition in each of the alternatives.

- Forest Composition
- Forest Age and Stocking
- Forest health

Forest vegetation management

These four elements provide a valuable comparison of effects on ANF forest vegetation, or the outcomes, from the combined treatments within each alternative. Past and anticipated activities on ANF, State, and privately owned lands that affect forest vegetation in the cumulative effects analysis area are also discussed in this section. They provide important indications of the condition of the forest vegetation on the ANF and cumulative effects area over the short-term (next twenty years), as it relates to the issues or concerns identified for plan revision. These short-term changes also can be used to help project what may happen over the long-term (next 50 years).

The following summary of anticipated cumulative effects takes into account both what has happened and what can reasonably be expected to take place on both public and private land within the cumulative effects area.

Table 3-38. Vegetation within four county cumulative effects area (percent)

Ownership Class	ANF	Surrounding Four-County Area
Total Forest	97	84
Total Non-forest	3	16

Forest composition

This section is divided into two discussions: one concerning the amount of non-forested lands anticipated and the other concerning forest type outcomes anticipated in each alternative. Table 3-38 displays the forested and non-forested lands on the ANF and surrounding four county cumulative effects area according to 2004 Forest Inventory and Analysis (FIA) data (Alerich *pers. comm.* 2006).

Non-forested lands – roads and other developed uses

Similar to the surrounding four-county area, 3 percent of ANF lands are considered to consist of shrubs and permanent grass openings. In addition to lands classed as permanent openings, approximately 5 percent (26,000 acres) of the ANF landbase is presently considered non-forested and developed for other uses, due to Forest system roads, non-system roads (including oil and gas roads), oil and gas clearings, gravel pits, and administrative sites.

Forest roads

Forest roads are required for a number of reasons, including transportation of forest products, public and administrative access. On the ANF, road construction has the effect of converting a forested corridor to a non-forested or non-vegetated condition where the roadbed lies.

Existing roads on the ANF (2,800 miles) occupies about 2.2 percent of the land base (includes both FS system, municipal, and privately-owned non-system roads). Of this, there are presently approximately 1,300 miles of FS system roads on the ANF, occupying roughly 1 percent of the ANF landbase. Management Area 3.0 presently contains the most miles of roads. One important indirect effect of forest roads that provide public access to forested areas can be reduced deer browsing impacts on understory vegetation. Hunting is considered the single most important factor affecting deer density on the ANF, and actual deer numbers are largely a function of hunter access and success. As a result, more remote portions of the ANF that provide little motorized access (such as MAs 5.0, 7.2, 7.3, 8.1, 8.2, 8.3, 8.5, and portions of 2.2 and 6.1), along with reduced forage availability may experience greater impacts from deer browsing. Conversely, areas that provide greater hunter access, such as MA 3.0, along with forage created and maintained by vegetation management, will experience lower impacts from deer browsing. Without hunting mortality to keep deer densities within bounds, deer populations will increase whether there is adequate forage or not (deCalesta *pers. comm.* 1997).

Road construction, reconstruction, and decommissioning activities, along with access management, vary by alternative. It is predicted that Alternatives A and B would result in a net increase of 100-120 miles of new Forest Service roads on new corridors, occupying less than 1 percent of the total ANF land base by 2025. Alternative D would require the least road miles to

implement, resulting in a net increase of roughly 40 miles of new roads. Alternatives A and B would consequently convert the most land area to a non-forested condition. Alternative D, conversely, would result in the least amount of new road construction (mostly in MA 2.1 and 3.0), and the largest amount of road decommissioning (most in MA 7.2). All alternatives would result in similar land clearing for gravel pits by the end of the second decade of implementation, roughly 100 acres. The alternatives do not vary in the percent of roads closed to public access year-round.

Cumulative developed lands

When viewed cumulatively with other land clearing activities, such as oil and gas development, all of the alternatives would result in roughly 8 percent of the ANF landbase cleared for Forest system roads, non-system roads (including oil and gas roads), oil and gas clearings, gravel pits, and administrative sites by 2025. The vast majority of new development is associated with privately owned oil and gas development on ANF lands, constituting nearly 2.6 percent additional clearing of ANF lands by the year 2025. New FS road construction and gravel pit development would result in less than 1 percent of the ANF land base developed, or converted to a non-vegetated condition, in any of the alternatives by 2025.

Summary of forest type outcomes

It is anticipated that forest types present today on most private lands in the cumulative effects area will gradually transition towards upland and northern hardwoods, with diminishing amounts of Allegheny and oak hardwood types.

One-half to two-thirds of the region's forests would need some form of remedial treatment (e.g. herbicide application, fencing) if preferred tree seedling species are desired (McWilliams *et al.* 2005). If disturbed, nearly half of Pennsylvania's forests would fail to adequately regenerate into a new forest of similar tree species composition (USDA FS 2004e). The lowest abundance of regeneration to satisfactorily regenerate forested areas was found in the Plateau Region, which includes the ANF (McWilliams *et al.* 2004). This holds true across various ownerships. At the same time, as noted by Nowak (1997), the amount of timber cut from non-industrial private landowners has been increasing in the past few decades. If these landowners don't take steps and make necessary investments to assure adequate, diverse seedling establishment on harvested areas, degraded species composition (particularly with regard to maintaining existing forest types) or loss of forest cover is likely, reducing the sustainability of these forests in the long term.

As summarized by Jones and Finley (1993), a number of factors influence sustainability of forest management on non-industrial private lands in the region and Commonwealth of Pennsylvania. These include:

- Short-tenured ownership (averaging less than 15 years)
- Lack of knowledge about forestry is pervasive among forestland owners

- Only an estimated 10 percent of Pennsylvania's non-industrial private forests are covered by written forest management plans (which would include reforestation plans)
- Timber harvest is supervised by a professional forester only an estimated 20 percent of the time.
- In Pennsylvania, non-industrial private forests supply about 80 percent of the raw material for the Nation's largest hardwood industry. Thus, the potential for long-term resource degradation is high.

On non-industrial private lands in the cumulative effects area, a trend towards upland hardwoods is anticipated due to harvest methods applied, and a lower level of reforestation treatments made to perpetuate forest types present on these lands today. Increasing thickets of understory beech are anticipated in particular on private non-industrial forest lands with a large beech component, where efforts are not made to remove prolific beech sprouts that prevent other tree species from becoming established. An increase in upland hardwoods on private non-industrial lands is anticipated largely due to the use of partial overstory harvests, with few associated reforestation investments. On non-industrial private lands in the cumulative effects area, the trend would likely be a reduction in Allegheny hardwoods, due to the reduced levels of reforestation investments that are often made on these lands to perpetuate this forest type. On private lands in the cumulative effects area, the trend would likely be a reduction in oak types, due to length of time it takes to successfully regenerate oak types (up to 20 years), as well as the large amount of reforestation investments needed to sustain this forest type (e.g. controlled burning, fencing areas, and releasing oak seedlings). Typically reduced levels of reforestation investments are made on private non-industrial forest lands in the cumulative effects area to sustain forest species composition.

In areas where no management will occur, including reforestation investments, over the long term beech, striped maple and birch are the species that would likely dominate the understory, midstory, and, eventually, the overstory in much of the cumulative effects area. It is possible that the seed-producing overstory would decline to the point where inadequate amounts of seed will be produced for successful, diverse natural regeneration. At the same time, interfering vegetation would create poor seed germination conditions or would prevent seedlings from becoming established, while continued deer browsing impacts would result in browsing of what seedlings do manage to become established. The virtual absence of oak regeneration on the Allegheny Plateau indicates that oak-dominated stands will likely transition to stands dominated by other species (primarily red maple) where no management or reforestation treatments occur in the cumulative effects area.

In the long term, all alternatives would result in changes to forest composition on the ANF, though Alternatives B and Cm would best sustain the relative abundance of forest types found on the ANF today.

Table 3-39. Structural size classes within four county cumulative effects area (Percent)

Ownership Class	ANF	Four County Area
Non-stocked	0	1
Seedling/Sapling (<5" diameter)	11	11
Pole-sized trees (6-10.9" diameter)	9	20
Large trees (>11" diameter)	80	68

Forest age and stocking

Table 3-39 displays the structural size classes of forest lands on the ANF and surrounding four county cumulative effects area according to 2004 Forest Inventory and Analysis data (Alerich *pers. comm.* 2006).

Nearly eleven percent of forest lands on the ANF are classed as seedling/sapling (less than 5 inches diameter at breast height); roughly the same amount as the surrounding four-county area and the Commonwealth of Pennsylvania. The ANF contains less pole-timber sized forest land (9%), than the surrounding four counties (20%). Overall, trees on the ANF are large compared with the surrounding four counties. Forest land on the ANF is comprised of about 80 percent sawtimber sized vegetation, compared to 68 percent in the surrounding four counties.

Like the ANF, most forests on adjacent private and other public lands within the four county area surrounding the ANF (Elk, Forest, McKean, and Warren) are also second growth and fairly uniform in age. These lands experienced similar natural disturbances and human caused influences for centuries as did the ANF.

From 1989 (USDA FS-NFES unpublished) to 2004 (Alerich *pers. comm.* 2006), areas classed as seedling/sapling forest (less than 5 inches diameter) decreased from 15 percent of areas classed by FIA as timberland on ANF to 11 percent. Areas classed as sawtimber (greater than 11 inches diameter) increased from 73 percent in 1989 to 80 percent in 2004.

Age class diversity

Pennsylvania has nearly 17 million acres of forest land. A long-term trend of decreasing seedling-sapling stands and an increase in sawtimber stands that are approaching financial maturity continues. Currently, 11 percent of the State forestland area is seedling-sapling stands. Statewide, the seedling-sapling class has decreased by well over 50 percent since 1955. The situation may have impacts on early structural habitat-dependent wildlife species. Statewide, sawtimber stands have more than doubled in area since 1955 (McWilliams *et al.* 2004).

From 1989 (Alerich 1993) to 2004 (Alerich *pers. comm.* 2006), the acreage in seedling-sapling sized trees on private non-industrial lands in the four-county cumulative effects area decreased from 16 to 12 percent. Statewide, harvesting on private lands is expected to remain constant or increase given current hardwood lumber values (Jacobson *pers. comm.* 2005). Final harvests on private lands are expected to increase in the next 20 years in the cumulative effects analysis area, over that which occurred in the past 20 years (see Table 3-42).

Similar to ANF lands, forests in the surrounding four county area are also maturing, and some are starting to develop late structural conditions, though harvesting activities particularly on private lands in the four county area affects the potential to develop late structural conditions in the long term. The four county CE analysis area includes approximately 660 acres of existing remnant old growth forest on State Lands at Cook Forest and Anders Run Natural area. Approximately 4,000 acres of remnant, original forest remains on the ANF. Although this makes up less than one percent of the total ANF acreage, it comprises approximately 12 percent of the total old growth forest in Pennsylvania (website accessed 4/3/06

<http://www.dcnr.state.pa.us/wlhabitat/forest/oldgrowth.htm>), and is the largest contiguous old-growth beech-hemlock forest in the northeastern United States (Ruffner and Abrams 2003).

Stocking

Table 3-40 displays present stocking levels based on 2004 FIA data (Alerich *pers. comm.* 2006). According to the table, the vast majority of forest vegetation on the ANF is classed as fully stocked or moderately stocked similar to the surrounding four counties and the Commonwealth of Pennsylvania. Industrial private lands have substantially greater proportions of forest lands in an overstocked or poorly stocked condition than any other land ownership class in the cumulative effects analysis area.

Stocking levels (relative densities) on the ANF are anticipated to remain fairly steady as stands mature and fill in, other areas decline and experience tree mortality that reduces stocking levels, and management activities maintain well stocked stands in all alternatives over the next 60 years. The exception to this would be areas with a substantial beech component, where beech tree mortality will likely result in lower overall stocking levels over the next 60 years, and a structural shift to smaller diameter understory trees.

Table 3-40. Area of forest land by ownership group and stocking class -- Elk, Forest, McKean, and Warren Counties – 2004 (thousands of acres)

Ownership	Non-stocked (0-9% relative density)	Poorly stocked (10-34% relative density)	Moderately stocked (35-59% relative density)	Fully stocked (60-100% relative density)	Overstocked (>100% relative density)	Total Forest Land ¹
Federal (ANF)	0	35.0 (7)	147.4 (30)	277.8 (56)	36.5 (7)	496.7
State/Other Public	1.7 (1)	5.1 (2)	100.8 (40)	127.0 (51)	14.3 (6)	248.9
Private Non-industrial	17.5 (2%)	51.8 (6)	294.3 (31)	505.8 (53)	76.8 (8)	946.2
Private Industrial	0	20.4 (39)	0	18.9 (37)	12.4 (24)	51.7
Total	19.2 (1)	112.3 (7)	542.5 (31)	929.5 (53)	140.0 (8)	1,743.5

¹ Total acres classified as forest land by 2004 FIA data (Alerich *pers. comm.* 2006)

Alternatives A, B, and Cm, which emphasize the use of even-aged management, would likely result in the highest level of poorly stocked stands being regenerated. This would result in young, fully stocked stands replacing older, poorly stocked stands. Over the long term, Alternative D, which places greater emphasis on uneven-aged management, would likely treat fewer of these poorly stocked stands.

Under an uneven-aged system it is not as feasible to treat poorly stocked stands, given less well stocked overstories and the need to invest in an increased number of reforestation activities. Stocking levels in areas managed under an uneven-aged system would vary, depending on whether group or single tree selection is applied. Most uneven-aged harvests would utilize group selection regeneration methods. Regular harvests under group selection generally result in an average residual relative density of 50 percent, whereas regular harvests under single tree selection would result in an average relative density of about 60 percent (Stout 1994, p. 337-338). There is also greater uncertainty in successfully developing abundant seedling regeneration under an uneven-aged system than an even-aged system. If insufficient seedling regeneration is developed, stocking levels in treated areas under uneven-aged management can be expected to decline. Alternative D reflects a reduced level of proposed regeneration and reforestation treatments on more of the Forest, resulting in less land area in a well stocked condition.

On private lands, stocking levels may decline somewhat due to periodic selective harvests, particularly where diameter limit cuts are applied and where investments are not made to develop seedling stocking to replace harvested overstory trees.

Understory and midstory condition

Concerns with interfering forest understories and overall lack of diverse seedling regeneration exist throughout the region. Recent sampling of seedling regeneration indicated deer browsing impacts are increasing the amount of understory interfering vegetation, which limits development of tree seedling regeneration, throughout the State of Pennsylvania. These findings indicate one-half to two-thirds of the region's forests would need some form of remedial treatment (e.g. herbicide application, fencing) if preferred tree seedling species are desired (McWilliams *et al.* 2005). If disturbed, nearly half of Pennsylvania's forests would fail to adequately regenerate into a new forest of similar tree species composition (USDA FS 2004e). The lowest abundance of regeneration to satisfactorily regenerate forested areas was found in the Plateau Region, which includes the ANF (McWilliams *et al.* 2004). Shifts in species composition between overstory trees and seedling regeneration are evident throughout the Allegheny Plateau region, primarily due to the effects of selective browsing by deer on species they prefer to eat. Statewide, species that are more abundant in the understory (seedling-sapling) than in the overstory include black cherry and birch, consistent with conditions observed on the ANF (USDA FS 2004e), though on the ANF, American beech is more than twice as abundant as any species in both the seedling and sapling classes (Morin *et al.* 2006). As noted by Horsley *et al.* (1994) the abundance and composition of this advanced seedling and sapling reproduction directly effects the future composition of the forest canopy.

High levels of deer browsing impacts have also affected private and other public lands within and surrounding the ANF. Industrial forests, private woodlots, and other public lands within the ANF are managed for forest products. Timber harvesting has occurred, and continues to occur, on private and other public lands within the ANF proclamation boundary. Due to the legacy of high deer browsing impacts in the area, industrial forest landowners, and forest managers on other public lands must presently employ similar reforestation techniques to develop desirable tree seedlings and ensure successful natural reforestation of regenerated areas.

Until recently, deer populations have been above the target levels established by state game managers and ecologists for the region to sustain ecosystem structure and health. It should be noted that in many areas on the ANF, interfering vegetation in the understory is already well established due to the legacy of deer browsing impacts that have existed on the ANF since the 1920s. This interfering vegetation will still need to be treated in order for a greater diversity of understory vegetation and tree seedlings to become established. With continued use of the Pennsylvania Game Commission's Deer Management Assistance Program, if lower deer populations are sustained, improvements in understory health and diversity should be evident with time. Consequently, there may be a reduced need for some reforestation activities, such as fencing, in the future. However, in all of the alternatives, there is some uncertainty concerning the need for future fencing, particularly in Alternative D where substantially less harvesting would occur and less forage sustained on the ANF landscape.

Where no vegetative management would take place, overstory stands would continue to mature. Established interfering vegetation and selective browsing impacts from deer would continue to limit the number and abundance of tree, shrub, and herbaceous species in most of the cumulative effects area. Current encroachment of fern, grass, striped maple and beech brush in the understory would inhibit growth of seedlings and spread as tree mortality in the overstory occurred.

Alternatives B and Cm propose the greatest amount of herbicide application, and therefore the greatest potential for a wider range of plant species to occupy the understory on the ANF. Alternatives A, B, and Cm would result in the most release treatments. Alternatives A and B propose the greatest amount of area fencing, while Alternative D proposes the least amount.

Forest wide desired conditions include restoration of diverse understory vegetation and enhancement of vertical diversity. In total, Alternatives A and B would treat the greatest number of acres to promote development of diverse tree seedling and other plant species in the understory and midstory. Alternative D would treat the least amount of acres on the ANF to improve understory and midstory structural conditions.

On private non-industrial lands in the cumulative effects analysis area, it is likely that few reforestation investments will be made to sustain the diversity of tree species today. On State and industrial forest lands in the cumulative effects analysis area, reforestation techniques are more likely to be applied to sustain forest cover and diversity in the long term.

Forest health

It is anticipated that existing forest health concerns present on the ANF, including the introduced beech bark disease complex, defoliations by both native and exotic insects such as the European gypsy moth, sugar maple decline, and the threat of hemlock woolly adelgid will persist on the ANF. Though it is difficult to predict the degree of impact from these stressors, particularly the cyclical populations of defoliating insects, droughts, and introduced exotic forest pests, it is likely that some form of chemical (e.g. insecticides), biological (e.g. introduced predators that feed on exotic insects) and cultural (vegetation manipulation) treatments will be necessary in order to reduce their impacts. Treatments such as application of *Bacillus thuringiensis* reduce defoliations from various forest pests. Systemic treatments, such as the selective use of imidacloprid or other appropriate insecticide may be necessary to conserve individual hemlock trees infested with the hemlock woolly adelgid (Ward *et al.* 2004). The ANF will continue to work with Forest Health Protection to monitor forest health on the ANF, and develop strategies to reduce the impacts of stressors such as defoliating insects. Changes currently taking place due to maturity or decline will continue on the ANF. The rate of change will be set by the interaction of natural forces such as additional drought, insect defoliations, or windstorms, or human caused forces such as introduced insects and diseases or atmospheric deposition.

Trees on adjacent private land within and around the ANF have been equally affected by numerous stresses and face the same forest health concerns described in the affected environment discussion for the ANF. In 1991 a defoliation epidemic occurred in northwestern Pennsylvania that continued through 1994. Major defoliators included elm spanworm, pear thrips, gypsy moth, cherry scallop shell moth, fall cankerworm, and forest tent caterpillar (in order of number of acres defoliated) (Pennsylvania Forestry Association, undated). Application of *Bacillus thuringiensis* to reduce defoliations from various forest pests occurred on private and other public lands within the ANF. Through observation, it appears they have experienced similar levels of mortality, decline, and blowdown as has the ANF.

As beech bark disease complex continues to spread within the ANF, individual beech and northern hardwood stands with concentrated pockets of beech will be affected by mortality of larger beech trees and subsequent root-sprout origin beech regeneration. Beech mortality (already evident in the northern portion of the ANF) will become particularly evident on the southern portion of the ANF, where the advancing front of the disease complex is present, and the killing front is in the process of arriving. The percentage of standing dead American beech is more than twice as great inside versus outside the killing front of beech bark disease (Morin *et al.* 2006). Stands with heavy mortality from the beech bark disease are often replaced by dense stands of susceptible beech sprouts that prevent the regeneration of other hardwood species (Latty *et al.* 2003), potentially resulting in a second beech bark disease outbreak of more serious impact than the first (Otrofsky and McCormack 1986). As almost all beech seedlings are of root sprout origin, those that do develop into saplings and small poles are clones of susceptible parent trees and will also be affected by beech bark disease complex. This is of greatest concern in areas with a high beech concentration where no active management will occur to promote the regeneration of other tree species. Conversely, in actively managed areas it is anticipated the effects of this disease complex will decline over time as beech trees susceptible to the disease complex are removed, and healthy beech trees are retained. In the long-term, the proportion of beech trees resistant to the disease may increase, as observed in New

Hampshire (Leak 2006). According to 2004 FIA data (Alerich *pers. comm.* 2006), beech comprises the most trees per acre greater than 1" in diameter on the ANF (21%) compared to 17 percent in the surrounding four counties. This raises forest health concerns, as the most common tree stem occurring on the ANF is subject to the beech bark disease complex. The overall effects of this widespread beech mortality on forest composition and structure on the ANF and surrounding area are not fully understood yet.

Changes in soil chemistry have occurred on the Allegheny Plateau in the past 30 years, consistent with changes that occur as a result of atmospheric deposition of sulfates and nitrates (Bailey *et al.* 2005). Specifically, significant decreases in soil pH (increase in acidity), and calcium and magnesium soil nutrients have been documented, along with significant increase in available aluminum. Some uncertainty exists regarding future trends with atmospheric deposition, and continued affects on soil nutrient status on the unglaciated Allegheny Plateau. See Section 3.24 (air resources) and section 3.2.2 (soils) for a more discussion on anticipated cumulative effects of atmospheric deposition. Given past trends on the unglaciated Allegheny Plateau, where sugar maple occurs along plateau top and upper slopes, continued decline is expected. Sugar maple may not be sustainable on these sites.

The ANF and surrounding four counties contain similar amounts of eastern hemlock (23-24 stems per acre) (Alerich *pers. comm.* 2006). However, when all conifer species are included (particularly pines), the ANF contains less conifer stems per acre as a whole than the surrounding four county area. While the hemlock woolly adelgid is not found yet on the ANF, it was detected in the cumulative effects analysis area (Elk County) in 2005. This raises serious concerns over the future health of hemlock trees and associated ecosystems on the ANF and surrounding four-county area. If the hemlock woolly adelgid impacts more hemlock trees in the ANF four-county area, substantial mortality can be expected. However, the timing, location, and degree of any hemlock mortality is uncertain and difficult to predict.

Monitoring of hemlock woolly adelgid in New Jersey forests indicated mortality in the most heavily infested areas was above 90 percent (Mayer *et al.* 2002). Monitoring in this study indicates that one-third of the plots had an average of 95 percent mortality, and two-thirds had 34 percent hemlock mortality after 13 years of HWA infestation. Similar monitoring that occurred in southcentral Connecticut found overstory and understory hemlock mortality of 50 to 99 percent following up to 12 years of HWA infestation (Orwig 2002). Stands differed in their mortality rates, with some experiencing steadily increasing mortality, and others exhibiting large pulses of mortality in certain years. Hemlock saplings experienced similarly high mortality rates, and after 6 years of monitoring, only 20 to 30 percent were alive at any study sites. The result is more open canopy conditions, and increased understory light levels. Where substantial mortality occurs on the ANF, the hemlocks will most likely transition to deciduous species such as red maple and birch, particularly where deer browsing impacts are extensive (Ward *et al.* 2004). The potential replacement of much of the hemlock component by deciduous hardwoods will have long-term ecological and esthetic impacts, including the loss of habitat diversity and quality of terrestrial ecosystems (Ward *et al.* 2004).

For most tree species, the number of standing dead trees on the ANF is greater than for other forested portions of Pennsylvania (Morin *et al.* 2006). According to 2004 FIA data (Alerich *pers. comm.* 2006), the ANF (45.3 cubic feet per acre) contains about twenty percent more cubic volume in standing rotten

and salvageable dead trees than the four county region (36.8 cubic feet per acre). This can in part be explained by the beech bark disease complex, which has been progressing across Pennsylvania and the ANF from the northeastern corner. While the scale insect (advancing front) is currently present across the ANF and the killing front covers approximately 42 percent of the ANF (Morin et al. 2006), the advancing front has not spread throughout the entire State of Pennsylvania at this point in time. The higher number of standing dead black cherry trees per acre is likely due to the fact that the Allegheny Plateau, where the ANF is situated, contains a much greater proportion of black cherry than the remainder of Pennsylvania (Marquis 1975).

Forest vegetation management

Total acres managed by silvicultural system

On private industrial lands in the cumulative effects area, even-aged management is the primary method of regenerating forest stands, whereas on private non-industrial lands, partial harvests (thinning) are predominantly used, though there is also a smaller amount of even-aged regeneration harvest. Vegetation management on State Game Lands and State Forests is generally even-aged, similar to much of the ANF. Forest vegetation in State Parks in the cumulative effects boundary is not generally managed. Estimates of past and anticipated harvest activities on other land ownerships within the four county cumulative effects area were made by contacting various landowners and applying estimates made by Nowak (1997) for private non-industrial lands.

Harvest activity in the four-county cumulative effects area

Table 3-41 displays total harvest levels that have occurred on all lands in the cumulative effects analysis area in the past 20 years. As can be seen in the table, proportionally, total harvest rates in the past twenty years were similar on ANF, other publicly owned lands, and private industrial lands, while they were higher on private non-industrial forest lands in the cumulative effects analysis area. The bulk of harvests on private non-industrial lands can be classified as partial harvests, or thinnings. Final harvest rates in the past two decades were proportionally greatest on private non-industrial lands (10%), and the least on ANF (6%) lands, compared with other ownerships in the four county area. Selective harvests on private lands that result in multi-age stands result primarily from diameter limit cutting.

When viewed across all ownerships in the entire cumulative effects analysis area, final harvests have occurred in the past two decades at a rate of 4 percent per decade, thinnings at 13 percent per decade, and selection or multi-age harvests on an estimated 1 percent per decade.

Table 3-41. Harvest type acres by ownership class for Elk, Forest, McKean, and Warren Counties, 1986-2005

	Total Forest Land Ownership ¹ -Thousands of Acres	Thousands of Acres by Harvest Type (Percent of Ownership Group)			
		Final Harvest	Intermediate Thinning	Selection / Multi-Age	Total Harvest
Federal (ANF)	496.7	28.5 (6%)	51.9 (10%)	6.1 (1%)	86.5 (17%)
State/Other Public	248.9	18.9 (8%)	23.3 (9%)	.3 ($<1\%$)	42.5 (17%)
Private Non-Industrial	946.2	95.3 (10%)	378.4 (40%)	19.0 (1%)	492.7 (52%)
Private Industrial	51.7	4.1 (8%)	5.7 (11%)	0	9.8 (19%)
Total (% of CE Area)	1,743.5	146.8 (8%)	459.3 (26%)	25.4 (2%)	631.5 (36%)

¹ Total acres classified as forest land by 2004 FIA data (Alerich pers. comm. 2006)

Table 3-42. Harvest projections decades 1 and 2 by ownership class for Elk, Forest, McKean, and Warren Counties

Ownership Class	Total Forest Land Ownership ¹ -Thousands of Acres	Thousands of Acres by Harvest Type (Percent of Ownership Group)			
		Final Harvest ²	Intermediate Thinning	Selection / Multi-Age ³	Total Harvest
State/Other Public	248.9	26.7 (11%)	17.7 (7%)	0.4 ($<1\%$)	44.8 (18%)
Private Non-Industrial	946.2	151.4 (16%)	211.0 (22%)	75.7 (8%)	438.1 (46%)
Private Industrial	51.7	8.3 (16%)	11.4 (22%)	0	19.7 (38%)
Federal (ANF)	496.7	44.6 (9%)	25.1 (5%)	0.1 ($<1\%$)	69.8 (14%)
Alternative A					
Federal (ANF) Alternative B		42.5 (9%)	16.9 (3%)	7.3 (1%)	66.7 (13%)
Federal (ANF) Alternative Cm		34.2 (7%)	20.0 (4%)	9.9 (2%)	64.1 (13%)
Federal (ANF) Alternative D		15.1 (3%)	5.1 (1%)	6.0 (1%)	26.2 (5%)
Total	1743.5				
Totals in Thousands of Acres for Four County Cumulative Effects Analysis Area (Percent of Cumulative Effects Analysis Area)					
Alternative A	1743.5	231.0 (13%)	265.2 (15%)	76.2 (4%)	572.4 (33%)
Alternative B		228.9 (13%)	257.0 (15%)	83.4 (5%)	569.3 (33%)
Alternative Cm		220.6 (13%)	260.1 (15%)	86.0 (5%)	566.7 (32%)
Alternative D		201.5 (12%)	245.2 (14%)	82.1 (5%)	528.8 (30%)

¹ Total acres classified as forest land by 2004 FIA data (Alerich pers. comm. 2006).

² For ANF ownership, represents final harvested acreage. Acreage for shelterwood seed cuts are not displayed.

³ For ANF ownership, represents acreage that receives a first entry harvest under an uneven-aged system. This can represent improvement cut or single tree selection harvest followed by group selection harvest. Acreage for second or subsequent harvests are not displayed.

Table 3-42 displays the total harvest activities anticipated to occur in the four county cumulative effects analysis area in the next two decades. These estimates were made by contacting various landowners within the cumulative effects area, using past treatment levels to project future harvest, and applying techniques used by Nowak (1997) to estimate harvest on private, non-industrial lands.

As can be seen in the top portion of the table, Alternatives A, B, Cm, and D would all result in lower total harvest rates than private lands in the cumulative effects analysis area. Alternative D would result in substantially lower total harvest levels through 2025 (less than half of any of the other alternatives considered). Total harvest levels on non-industrial and industrial private lands are anticipated to be substantially greater than levels proposed on ANF lands in any of the alternatives. The bulk of harvest anticipated on private lands through 2025 is anticipated to consist of intermediate thinning harvests.

Final harvests on private lands are expected to increase in the next twenty years, over that which occurred in the past twenty years (see Table 3-41 and Table 3-42). These rates are assumed to increase in the next twenty years over past levels due to the increasing maturity and value of forests in the four-county region surrounding the ANF, though this increase is not assumed to occur Statewide. It is feasible, given overall harvest levels projected in Alternative D, and an associated decrease in timber products supplied by the ANF, that harvesting on private lands near the ANF might increase even more under that alternative as suggested by Strauss et al. (2004). Often this harvest on private lands occurs without reforestation investments made, resulting in a poorly stocked (see Table 3-40, stocking class by ownership) pole-sized stand (see Table 3-39, structural size class by ownership) of residual lower values trees, rather than young, seedling stands that are well-stocked with desirable seedlings.

Overall, trees on forest lands in the four counties surrounding the ANF are large compared to the rest of the Commonwealth of Pennsylvania. Forest land on the surrounding four counties is comprised of about 71 percent sawtimber sized vegetation, compared to 59 percent on forest lands in the rest of the Commonwealth of Pennsylvania (Alerich *pers. comm.* 2006). The surrounding four counties contain a higher proportion of high value black cherry than the remainder of the Commonwealth, and nearly double the per-acre volume of Grade 1 sawtimber compared the rest of the Commonwealth. It is anticipated that final harvest rates on private lands (16%) will be greater than either ANF lands (3-9%) or other publicly owned lands (11%) in any of the alternatives considered. ANF final harvest rates are somewhat higher than those anticipated on other publicly owned lands in the cumulative effects analysis area, while a greater amount of thinning is anticipated on ANF lands in all alternatives than on other publicly owned lands in the next two decades. In general, all harvest activities are anticipated to be higher on privately owned lands than the ANF in all alternatives, particularly thinning and other partial harvests.

Cumulatively, along with private and other publicly owned lands, Alternatives A, B, and Cm would result in very similar levels of intermediate and final harvesting through 2025 in the cumulative effects analysis area, while Alternative D would result in slightly less thinning and

final harvesting. Similar amounts of selection harvest are expected to occur across all ownership groups in Alternatives B, Cm, and D through the second decade in the cumulative effects analysis area, and less in Alternative A. Total harvest levels within the cumulative effects analysis area vary little between alternatives, with Alternatives A and B resulting in harvest activities on the largest portion (33%) of the cumulative effects area, followed by Alternative Cm (32%), and Alternative D on the smallest portion (30%).

Overall, the past level of total harvest (36%) is more than levels anticipated in the next 20 years (30-33%) in the cumulative effects area, under any of the alternatives.

Total harvest and reforestation acres

Within the cumulative effects area, current trends on non-industrial private lands include low investment high-grading harvests with a limited amount of reforestation investments, which results in lower value stands often moving toward northern (often beech stems susceptible to beech bark disease complex) or upland hardwood (predominantly birch species) type composition. Forest products harvested from the ANF contribute to regional economies and a dependable supply of timber. Silvicultural activities on the ANF have, and will continue to serve as a model for forest stewardship and sustainable forestry practices on private lands (see LRMP Goals 2400 Vegetation). On industrial private forest lands, management is considered more sustainable than management on nonindustrial private lands, with investments made to the reforestation of harvested areas. On other public lands near the ANF where forest management occurs, similar silvicultural and reforestation techniques to those applied on the ANF are utilized.

3.3.2 Plant and Animal Habitats

The primary change between draft and final was the addition of the mourning warbler as a Management Indicator Species for early structural habitat. Based on changes in the SPECTRUM model and changes in management areas under Alternative Cm, some refinements were made to acreages of early, mid, and late structural habitat, percentages of oak that would be managed and unmanaged, percentages of remote habitat, and acres managed for connectivity and as core areas. The Wabash pigtoe was added as a species with viability concern, and the Northern goshawk was added as a Regional Forester Sensitive Species. The viability outcomes and rationale were refined and strengthened.

Introduction

The National Forest Management Act (NFMA) requires the Forest Service to provide for diversity of plant and animal communities based on the suitability and capability of the specific land area so that overall multiple-use objectives can be met. The 1982 regulations implementing the NFMA direct National Forests to provide habitat that can maintain viable populations of existing native and desired non-native vertebrate species in the planning area (36 CFR 219.19). Additional direction extends this mandate to include vascular plants (USDA Regulation 9500-4).

These regulations direct that habitat be provided to support, at least, a minimum number of reproductive individuals. That habitat must be well distributed so that individuals can interact with others in the planning area (36 CFR 219.19).

More than 300 aquatic and terrestrial vertebrate species, in addition to countless invertebrates and over 1,200 plant species are known to inhabit the ANF sometime during their life cycle. Species viability evaluations (SVEs) conducted as part of Forest Plan revision demonstrated that habitat diversity is the key to the conservation of these plants and animals (Appendix E).

Evaluation of species viability concluded that the ANF plays a primary role in providing habitat for species with viability concerns. One example is the timber rattlesnake, a species that is declining throughout Pennsylvania as human activities increase throughout its habitat (Urban 2005). Another example is the northern flying squirrel, where the only documented population in western Pennsylvania occurs within the ANF proclamation boundary (Turner 2005). Important aquatic species include two federally endangered mussels, the Clubshell and northern riffleshell. The Allegheny River contains the largest populations in the world of these two species. The small streams found throughout the ANF contain habitat that supports mountain brook lamprey, numerous darter species, and several other rare fish. The Allegheny Reservoir supports a growing population of bald eagles and ospreys and is considered a key source habitat for recovery of these species in northwest Pennsylvania.

Some plant and animal species provide visitors to the ANF with a wide variety of recreational opportunities, such as hunting, fishing, and nature viewing. Major game species include white-tailed deer, black bear, wild turkey, ruffed grouse, American woodcock, squirrels and others. Many streams flowing through the ANF provide brook, rainbow, and brown trout fishing opportunities. The Allegheny River and Reservoir provide walleye, northern pike, muskellunge, and small mouth bass fishing. Special forest products such as ground pine are also collected.

Organization of the analysis

To address the requirements for maintaining diversity and viable populations, a two-part approach that is referred to as a “coarse-filter/fine-filter” approach was used (Haufler *et al.* 1999).

Coarse-filter analysis refers to evaluating biodiversity conservation through a classification and assessment of the component ecosystems that make up a landscape (Haufler *et al.* 1999). It is based upon the theory that conserving an adequate representation of natural plant and animal communities will maintain most species that occur in a given planning area (Haufler *et al.* 1999). In conserving representative communities, natural disturbance regimes and the historic range of variability of natural communities are considered (Haufler *et al.* 1999). The historic range of variability, generally defined as the range of communities and forest structure classes that existed prior to European settlement, represents conditions to which native species and communities are best adapted. It measures how close the coarse-filter strategy comes to providing representation of natural communities. A summary of the SVE process can be found in Appendix E of this FEIS. For more information on natural communities, disturbance and historic range of variability please refer to the Ecological Context report for the ANF (USDA FS 2006).

The coarse-filter analysis begins with a description of how the ANF fits into the National Ecological Framework, beginning at the broad Province scale and narrowing to the Land Type Association (LTA) scale. This ecological

description is followed by an analysis of key habitats that influence the distribution and abundance of wildlife on the ANF. Management indicators are identified to focus monitoring efforts during LRMP implementation. Landscape level conservation approaches to provide plant and animal habitats across the landscape are primarily incorporated into LRMP objectives and management area allocations. In general the objective is to identify rare, declining, or threatened ecosystems and evaluate how well the alternatives conserve them.

Evaluation

Several analyses were completed to help develop the indicators and evaluate the alternatives. These include the SVE which includes the ecological context, the biological assessment (BA) and biological evaluation (BE) of federally-listed, threatened and endangered species, Regional Forester Sensitive Species (RFSS), and comments from the public including comments from agencies and organizations provided throughout the planning process. As part of the consultation process on federally listed species, a biological assessment was prepared and submitted to the USFWS; the same information which is included in the BE.

These analyses provided some key findings about current habitat conditions which were summarized in the Ecological Context:

Key findings

The land area that now comprises the ANF has undergone significant environmental, biological and social change since its first human occupation approximately 12,000 – 15,000 B.C. Natural disturbance regimes of wind, ice, drought, native insects and diseases continue to shape the landscape. Ecological conditions are further modified by non-native invasive species, land use patterns, and resource utilization. By 1920, the once vast expanse of northern hardwood forest in the region was almost completely clearcut and eventually replaced by shade intolerant species such as black cherry and red maple. In the absence of fire set by Native Americans, oak forests along the Allegheny River and its major tributaries are slowly changing to forests of red maple and birch. Since the discovery of oil in the region in 1859, oil and gas extraction is still an important commodity actively pursued in the region. Plants and animals have adapted to changing conditions, migrated or have gradually become either extinct or extirpated from both natural and human causes.

High water quality, aquatic species richness, and large forested blocks of core habitat are repeatedly identified as important contributions the ANF provides to larger regional landscapes. Specifically, East Hickory Creek watershed, Hickory Creek Wilderness Area, the Allegheny River subbasin, and Tionesta Scenic and Research Natural Areas are noted as high value areas for biodiversity conservation.

The Allegheny River subbasin and the ANF are located within the Teays-Old Ohio ecoregion, which is considered globally outstanding because of its aquatic species richness. East Hickory Creek in the Hickory Creek Wilderness area has been recognized by the National Water Quality Assessment program as having the best quality (based on aquatic invertebrates) nationally of the 140 sites sampled between 1996 and 1998.

In the High Allegheny Plateau Ecoregion (The Nature Conservancy), the ANF holds the largest managed contiguous area of the nearly 20 percent (approx. 3,319,000 acres) of the ecoregion held by organizations with a conservation mission. This ecoregion has the highest percentage of natural cover (81%) of any northeastern

ecoregion and a number of primary target species are known to occur within or adjacent to the ANF. Within the ANF, Tier 1 matrix forest blocks, selected as high quality examples of representative forested ecosystems, are Hickory Creek, Tionesta, and part of the Allegheny State Park block. The adjacency of the ANF to Allegheny State Park in New York has regional significance as an important forested core area.

At the mid-Atlantic scale, important findings for the ANF, relative to the five-state region, include low human population density, air pollution is high, and ozone exposure is moderate. Forest cover is high on many streams, a moderate number of streams have roads within about 100 feet, and there is a low density of impounded streams. Soil erosion is low, forest cover is high, and forest edge habitat is low. The amount of forest interior habitat is high and the average forest patch size is large.

At the state scale, the ANF is part of the Allegheny High Plateau Ecoregion which was ranked “very good, with the highest stream quality for the state and the largest block of core forest, with critically important concentrations of forest wildlife”. Hickory Creek and Tionesta Creek areas are identified as Important Mammal Areas and Tionesta Scenic and Research Natural Areas and part of the East Hickory Creek watershed are recognized as Important Bird Areas.

Under the National Framework of Ecological Units, the ANF is located within Province 212 – Laurentian Mixed Forest, Section 212G – Northern Unglaciaded Allegheny Plateau. The ANF lies completely within the Subsection 212Ga and comprises about a quarter of the acreage within this subsection. The Subsection is further divided into Landtype Associations (LTAs) and Ecological Landtypes (ELTs). Ecological conditions were quantified at the forestwide scale using LTAs and a multi-scaled approach to analyze wildlife habitat relationships.

The largest LTAs within the ANF are 212Ga3 and 212Ga4. While the larger LTAs generally contain the highest proportions of features when summarized across all LTAs, there are notable exceptions. LTA 212Ga2 is characterized as low and wet/high and dry with a relatively high proportion of poorly drained soils, bottomland and plateau landforms, openings, and aspen, including most of MA 1.0, which emphasizes early successional species. Of note, nearly one-third of the oak type occurs in 212Ga10 and is abundant along the Allegheny and Clarion river drainages on the steeper, drier slopes. 212Ga10 contains the highest proportions of MAs 6.1, 6.2, and 6.4, management areas that tend to emphasize more mature forest and less young age classes. Thirty percent of unroaded areas also occur in 212Ga10.

The ANF, being mostly forested, contains approximately 25 percent more mature forest than the Commonwealth of Pennsylvania and almost twice that of the Mid-Atlantic region. The ANF provides ‘core’ forest areas with less human disturbance than the state or Mid-Atlantic region, important for many wildlife species. Allegheny hardwoods occur more often in the eastern and central part of the ANF, while northern hardwoods range northward and upland hardwoods are scattered throughout. Conifer and mixed conifer generally make up less than 10 percent of forest cover within each LTA and tends to occur along stream drainages. Aspen is a minor component throughout. Vertical diversity and understory development is lacking and negatively affected by high deer populations and invasive plant species. Horizontal diversity is relatively low in areas managed for late successional habitat and moderate on most of the forest where there is a mix of mature forest conditions and younger age classes.

Most of the ANF is in the mid-successional stages of 21-149 years old while a small proportion of the forest is less than 21 years old and stands greater than 149 years old are lacking. Although the amount of forest land in the State has increased, early successional forest has been declining statewide since the early part of the 20th century, a trend similar to the Mid-Atlantic Region. The amount of early successional forest, although relatively stable on the ANF, is still a relatively low proportion of the age class distribution. The ANF contains a much smaller non-forest component compared to the state, and most of the non-forest habitat occurs as openings less than 50 acres.

The ANF has abundant streams, springs and seeps, and several large river valleys, however, lacks extensive floodplain development due to topography and impoundments on major rivers. The steepest terrain occurs around the major river valleys of the Allegheny and Clarion Rivers, and Kinzua and Tionesta Creeks. Average stream density is 1.0 mi./sq. mi. MA 6.1, while a relatively small land area with fewer perennial streams, contains the most documented TES species from nineteen streams surveyed. The Allegheny Reservoir (~8,000 ac.) is the largest impounded body of water within the ANF.

Most of the road miles within the ANF are from non-system roads (not municipal or part of the Forest Service road system). Forest Service road miles make up about 30 percent of road miles in each LTA. Most of the roads within the ANF are closed to public use. Areas of high road density are attributed to oil and gas developments, major towns, and developed recreation areas. Oil and gas activity is widespread across the ANF and is currently undergoing a period of heavy expansion and is the most significant land use change over the past 20 years.

The largest area of “stewardship lands,” lands with a conservation emphasis also known as conservation lands, in Pennsylvania is located in the north-central region where a stronghold of public lands is located, including the ANF. While the ANF only has jurisdiction over approximately 11 percent of the National Gap Analysis Project status 1-3 conservation lands statewide, within the ecoregion (212Ga – Subsection), the ANF has jurisdiction over 95 percent of the status 1 lands, 100 percent of the status 3 lands and 72 percent of the total conservation land. As a whole, stewardship lands play a critical role in conserving Pennsylvania’s plant and animal species and are important because they can provide a relatively high degree of protection from human disturbance.

Presently, approximately 20 percent of the ANF has management emphasis for late successional and old growth values. Old growth management lands contain a larger oak and conifer/mixed hardwood component and a smaller Allegheny hardwood component than the ANF as a whole. While there are no known old growth obligate species, the abundance and diversity of many species have been found to significantly increase in old growth stands. Approximately 4,000 acres of old growth forest occur on the ANF. Although this makes up less than 1 percent of the total ANF acreage, it comprises approximately 15 percent of the total old growth forest in Pennsylvania.

Forest health on the ANF has been affected by a variety of insects, diseases, invasive plants, herbivory, droughts, windstorms, atmospheric deposition, and local site nutrient factors. In addition to the loss of American chestnut, one of the most striking effects in recent times has been the loss of mature American beech to beech bark disease. Cumulative acres defoliated by native and exotic insects exceeded one million acres between 1982 and 2003. The loss of open space and wildlife habitats by development is the largest threat to terrestrial and aquatic habitats in Pennsylvania. On the ANF, mineral development poses the most significant land use changes.

Based on all of the analyses plus comments we received from the public and various agencies the following indicators were developed to help evaluate the effects of the alternatives on habitat diversity.

1. Amount and trends in habitat structure across the landscape with emphasis on early structural habitat and late structural habitat provided during the first two decades (2020) and over the long term (2060).
2. Amount and trends in habitat composition with emphasis on changes in the quality and quantity of oak (an important habitat for many plants and animals). Conifer, wetland/riparian and aquatic habitats were determined to be important habitats but were generally not affected differently between alternatives.
3. Changes in habitat patterns across the landscape with emphasis on providing larger patches of late structural habitat and habitats with less human disturbance (described as remote habitat).
4. Amount and trends in habitat for Management Indicator Species: northern goshawk, cerulean warbler, timber rattlesnake, mourning warbler, and aquatic invertebrates.
5. Amount and trends in habitat for game species and other species of public interest.
6. Amount and trends in populations and habitat for species with viability concerns.

Affected environment

The affected environment provides a description of the current conditions in terms of the six habitat indicators.

Habitat indicator 1: Amount and trends in structural class diversity

Early, mid, and late structural stages have been defined for the ANF based on the size of the dominant vegetation layer and percent canopy closure (Table 3-43). Used in modeling, these structural stages result from a number of previously discussed factors that affect forest vegetation, including historical harvesting, deer browsing impacts, natural disturbances, anthropogenic influences, mortality from various agents, recent vegetation management, and composition and age of forest stands on the ANF. A definition of the early, mid, and late structural stages to be used in this analysis is provided in the following table. The term “structural” rather than “successional” is used to describe the vegetation conditions (diameter of the dominant vegetation) rather than the species composition (e.g. aspen is an early successional species). Because structural stages are utilized differently by a wide variety of plants and animals, they are an indicator of changes in plant and animal habitats as management activities change between alternatives.

Early structural habitat

Young forests (early structural forests)

Habitat for early structural species includes primarily seedling and sapling communities or forested stands primarily in the 0-20 year age class, as well as open areas where woody vegetation is encroaching. Of the species that utilize these habitats on the ANF, approximately 30 species utilize exclusively seedling/sapling habitat, while another 150 species utilize a combination of mature and regenerating forest conditions (adapted from DeGraaf *et al.* 1992). While early structural habitat has been declining across the State and Region, on the ANF, this community has been maintained on approximately 7 percent of the ANF for the last 20 years. The mourning warbler is the management indicator species for early structural habitat.

Table 3-43. Description of structural stages used in SPECTRUM modeling for the ANF.

Dominant Characteristics of Structural Stage					
Label	Canopy Closure	Herbaceous Layer	Shrub (<5 ft)	Tree	Representative Wildlife Species
Early Structural Characteristics					
Seedling/Sapling	40-100%	Robust to Sparse-scattered	Robust to sparse-absent	Seedling (<1 in. dbh*) Sapling (1-5 in. dbh)	Chestnut sided warbler, mourning warbler Swainson's thrush, ruffed grouse, broad winged hawk, Eastern cottontail, Eastern milk snake Veery, rose-breasted grosbeak, ruffed grouse, eastern towhee, snowshoe hare
Savannah	<40%	Robust	scattered	Woody 0-99 in. dbh	Eastern bluebird, common yellow throat, song sparrow, red-shouldered hawk
Mid Structural Characteristics					
Pole	40-100%	Sparse-absent to Patchy	Infrequent to Patchy	Trees (5-20 in. dbh)	Indigo bunting, woodland jumping mouse, Hermit thrush, black-throated green warbler, scarlet tanager, ovenbird, red-eyed vireo, red-shouldered hawk
Late Structural Characteristics					
Late	40-100%	Scattered-dense to patchy	Scattered	Trees (20-99 in. dbh)	blackburnian warbler, hoary bat, bald eagle, fisher, N. flying squirrel, N. goshawk

* DBH – Diameter at Breast Height.

Late-structural habitat

Old forests (late structural forests)

For this analysis, late structural forests have a dominant layer of trees with diameters greater than 20 inches. Specific characteristics of late structural forests on the ANF include increased amounts and sizes of standing dead and down wood, large diameter trees, often with a hemlock component and canopy gaps with understory and mid-story development. Although old growth characteristics may begin to develop at 110 years of age, a full complement of these characteristics usually develop at about 300 years old.

The 1986 Forest Plan contained direction for providing old growth habitat in various MAs. No spatial criteria for implementing that direction in site-specific projects was provided. During the early stages of analysis for Forest plan revision, it was determined that old growth characteristics would be provided in portions of MAs 2.1, 2.2, 6.1, 7.2, 7.3, 8.1, 8.2, 8.3, and 8.5. The small parcels selected to provide old growth characteristics in past site-specific projects in Management

Area 3.0 were reviewed to determine if indeed they would provide large trees, large standing and down dead wood, canopy gaps, and a multi-layered vertical structure.

On the ANF, the Tionesta Scenic and Research Natural Areas and the Hearts Content Scenic Area contain remnant old forests that have never been harvested. Estimated at 300 years or older, these forests are called remnant old growth; a subset of late structural forests.

While there are no known old growth obligate species, the abundance and diversity of many species have been found to significantly increase in old growth stands (PA Game Commission 1998 draft). Of the more than 300 vertebrate species inhabiting the ANF, more than half use late-structural habitats (Degraaf *et al.* 1992). About 20 of the 78 species with viability concerns on the ANF utilize late structural forests (Appendix E).

Another method of evaluating structural conditions across the landscape is to examine the desired landscape conditions produced by each management area (Table 3-44). By totaling the acres of each Management Area that produces a certain landscape condition, the amount of each landscape condition can be determined. Vertical diversity is a measure of foliage height diversity.

Table 3-44. Landscape codes used to describe desired landscape conditions and management activities by management area.

Landscape Code	MAs	Desired Landscape Conditions	Management	Vertical Diversity	Horizontal Diversity
1 (7%)*	2.2, 5.0, 7.2, 7.3, 8.2, 8.3, 8.5	Predominantly late structural conditions with a continuous forest canopy. Some scattered inclusions of early structural and small openings.	Predominantly passive management. Some active management.	High	Low
2 (26%)*	2.1, 6.1	Predominantly mid to late structural conditions with a continuous forest canopy. A small early structural and opening component exists.	A combination of passive and active management	High	Low
3 (65%)*	3.0, 6.2, 7.1, 8.6, 9.1	Predominantly forested landscape with a mix of mid and early structural conditions. Openings of various scattered across the landscape.	Predominantly active with some areas of passive management	Moderate	High
4 (2%)*	1	A combination of early and mid-structural stages with openings of varying size evident throughout the area.	Active management	Low	High
5 (<1%)*	6.3, 8.1, 8.4	Landscape dominated by forested savannas, open bodies of water and riparian vegetation.	Active management with areas of passive management	Low	Moderate

* - % of the Forest

In other words, vertical diversity is the diversity of vegetation layers beginning at ground level and moving upward to the tree tops. Horizontal diversity is a structural feature of a habitat describing the regularity of vegetation as it is distributed in the horizontal plane (Cooperrider *et al.* 1986. pg.647-648). The cerulean warbler and northern goshawks are late structural management indicator species.

Landscape diversity

Each management area identified in the LRMP has a different landscape condition and management emphasis, both of which affect wildlife and wildlife habitat. Wildlife species abundance and composition is greatly affected by the spatial relationships of available habitat or horizontal diversity. Similarly, structural conditions within stands or sites, or vertical diversity also greatly affects wildlife use and distribution. Table 3-44 groups MAs with similar desired landscape condition and management and assigns a “landscape code” to similar MAs, identifies the desired landscape condition and management within each, and provides a relative index of the vertical and horizontal diversity.

Openings

Approximately 53,000 acres of the ANF are classified as non-forest habitat, including 15,000 acres of permanent openings. Of these 15,000 acres, 85 percent exists as perennial herbaceous openings, 7 percent as upland shrub openings, and 8 percent as lowland shrub openings. The remaining acreage occurs as openings created from wells and road corridors.

Most of the existing herbaceous and shrub habitat occurs as smaller openings <50 acres in size and less than one percent, of the forest occurs as larger openings greater than 50 acres (41 sites), that would be preferred by most grassland species. On the ANF, 10 of the 19 grassland bird species that occur are considered area sensitive (Brauning 1992), or grassland species that prefer larger openings. These larger grasslands take on greater significance when you consider that intact grasslands large enough to support breeding populations of some of the more area-sensitive species and those with larger home ranges are rare in the Allegheny Plateau Physiographic Region (Robertson and Rosenberg 2001). As a result, larger fields are the highest priority in terms of maintenance for grassland species. While there are 11 grasslands greater than 100 acres in size on the ANF, only two fields exceed 150 acres in size.

Presently very little shrub habitat occurs on the ANF. However, shrub habitat that exists along power line and pipeline corridors provides habitat for many shrub nesting species (Robertson and Rosenberg 2001). This is a consideration on the ANF, since there are over 600 miles of utility rights-of-way across the ANF. Additionally, management of larger rights-of-way and small shrub openings has further implication on the ANF, since many shrub species can take advantage of small habitat patches distributed across predominantly forested areas (Robertson and Rosenberg 2001), such as the ANF.

Upland non-forest communities provide basic habitats for distinct groups of species. These non-forest types are seasonally important elements for wildlife that also use forested habitat. Although regenerating forest less than 10 years of age serves as temporary openings, wildlife communities associated with upland non-forested habitat are quite different from those found in regenerating

forest stands. This difference is largely due to the amount of dense, herbaceous cover, which lasts longer in permanent openings than in regenerating stands. The presence of non-forest vegetation is necessary for over 50 vertebrate species found on the ANF. Of these, nine rely totally on non-forested habitat (adapted from DeGraaf *et al.* 1992).

Habitat indicator 2: Amount and trends in habitat composition

Habitat composition is an important consideration when analyzing habitat quality and quantity. The amount and distribution of oak forests, conifer forests, riparian and wetland habitats, and aquatic habitats are analyzed for the ANF. Riparian and wetland habitats have a high diversity of plant and animal species. Riparian and wetlands are analyzed under the Water Resource section.

Oak and conifer components

Unlike much of Pennsylvania's woodlands, oaks on the ANF primarily occur in the major river drainages. Only about 15 percent (73,000 acres) of the ANF is comprised of oak and oak transition types. More than 90 species of wildlife consume acorns (Martin *et al.* 1961) including game species such as, deer, wild turkeys, black bears, ruffed grouse, and squirrels, and non-game species such as deer mice, chipmunks, blue jays, and red-headed woodpeckers (DeGraaf *et al.* 1992; McShea and Healey 2002). Cerulean warblers are the management indicator species for oaks.

Conifer, primarily hemlock but also white pine and red pine, is more prevalent on the ANF than in most of the hardwood forests of Pennsylvania (the exception is the Pocono Plateau) (Goodrich *et al.* 2003). Many north facing slopes and valley bottoms have a conifer component that ranges in density from a few scattered white pines across the hillside to a dense closed canopy of conifers that completely shade the forest floor. Red pine plantations, many of which were planted by the Civilian Conservation Corps (CCC) in the 1930s, are found on 9,900 acres of the ANF. Sometimes considered "biological deserts" because of their sparse understories with deep layers of pine needles and simple structure, these plantations are inhabited by red squirrels which are actively pursued by fishers. Brown creepers and nuthatches are also common in these plantations.

Conifers can provide protection from winter winds, cold temperatures, and deep snows (winter thermal cover) and protection from the hot summer sun (summer thermal cover). Goodrich *et al.* (2003) reported a high species richness of coniferous forest birds on the ANF. Swainson's thrushes, blackburian warblers, and barred owls utilize the large hemlocks in the Tionesta Scenic and Research Natural Areas and northern flying squirrels utilize the large hemlocks in the bottoms. Hemlock woolly adelgid is a potential threat to hemlock on the ANF (see forest vegetation section for details).

Wetland habitats

Springs, seeps, and vernal pools are considered wetlands because of the presence of hydric soils, water, and hydrophilic vegetation. The majority of springs and seeps on the ANF do not appear on topographic maps, and these unique ecosystems can be quite extensive.

Seeps primarily occur on strongly sloping to steep side slopes and low slope colluvial landforms. Seeps are important foraging and breeding habitat for some salamander and invertebrate species and the moist

corridors surrounding seeps are important for salamander migration and dispersal. The area surrounding the springs and seeps is also important to herbaceous plant distributions. During the winter months as the groundwater melts or reduces snow cover, seeps are important foraging areas for wild turkeys, deer, and other wildlife. Canopy cover around springs is needed to maintain micro-climate and prevent conversion to grass or fern cover.

Vernal pools are naturally occurring small pools or depressions that are inundated for a period of time each year, primarily late fall through spring, as a result of a combination of snowmelt, precipitation and high water tables. These pools dry up for a period of time, generally during the summer and early fall. Vernal pools are free of fish and the pool basin is utilized breeding habitat for pool-dependent amphibians and invertebrates. In addition to the breeding pools, the surrounding upland forest is critical habitat that is used by pool-breeding amphibians during their life cycle. Habitats adjacent to wetlands can serve as stopping points and corridors for dispersal to other nearby wetlands.

The amount of terrestrial habitats used during migrations to and from wetlands and for foraging defines the terrestrial core habitat of a population. This aggregation of breeding adults constitutes a local population centered on a single wetland or wetland complex. Local populations are connected by dispersal and are part of a larger metapopulation, which extends across the landscape (Semlitsch and Bodie 2003). Within this habitat, it is important to maintain forest floors with suitable conditions, such as minimal compaction and rutting, deep litter, coarse woody debris, and canopy shade (Calhoun and deMaynadier 2004). The Jefferson salamander and the four-toed salamander are two species with viability concerns that utilize forested vernal pools. These pools are crucial habitat because salamanders have a small home range that isolates them from surrounding populations and other landscape features.

Rivers, streams, and impoundments

Rivers and streams

Streams are numerous across the forest, and occur primarily as smaller cold headwater streams (1st-3rd order). Higher order streams (>4th), while not as numerous in miles, provide more habitat on a per mile basis due to their increased width and depth. These higher order streams also tend to be more productive and can support a higher diversity and abundance of aquatic species, including game and non-game fish and aquatic TES species. Examples of the larger streams on the ANF include Tionesta Creek and its branches, Kinzua Creek, Spring Creek, and the two rivers, Clarion and Allegheny.

Extensive fisheries surveys have been conducted Forest-wide since the 1986 Forest Plan was approved. Where water quality is suitable for the propagation of fish, a population of one or more species is usually encountered in streams as small as only a few feet wide. A number of streams have been newly documented as wild trout streams and are now included on the Pennsylvania Fish and Boat Commission's wild trout stream list.

A lesser amount of physical stream habitat surveys have been conducted. Of the physical habitat surveys that have been conducted, the most common element lacking in streams are quantities of large wood and in-stream cover, as well as pool quantity and quality. Larger, deeper pools are

important for holding larger mature fish, even in the smallest of streams. Stream temperatures and shading are adequate to support cold-water fisheries in headwater streams, with the exception of some streams that flow through savannahs. The majority of these savannah streams are in the southern part of the ANF in the Clarion River drainage. Wildfires in heavy logging slash in the early 1900s created these conditions, and to date limited tree regeneration has occurred to restock these areas.

While most streams on the ANF support fish populations, there are numerous ones that do not because of acidic water conditions. Some streams are naturally acidic due to soils and parent material. Fish and water quality surveys conducted on the ANF have documented numerous streams with low pH levels. These conditions can significantly affect biological diversity, habitat quality, and the ability to support a quality fishery. Sedimentation from dirt and gravel roads and trails to streams is another source of concern for aquatic habitat, especially with an increase in oil and gas development.

Class A trout streams, a Pennsylvania Fish and Boat Commission classification, are streams that support a high biomass of brook trout (>30kg/ha) or brook/brown trout combination (>40kg/ha). This is the highest classification a stream can attain, and currently only three streams on the ANF are classified as such.

Streams with state classifications of Exceptional Value, High-Quality Cold-Water Fishery, and Cold-Water Fishery provide potential habitat for numerous species. These streams include small cold headwater streams that occur in forested settings to larger streams such as Tionesta Cr. (CWF) and the Clarion River (CWF). MA 3.0 contains the highest amount of these classified waters that could (and do) provide habitat for game and non-game fish as well as TES species. Game fish that are primarily encountered in these streams are brook trout, brown trout, and smallmouth bass.

The warm-water fishery classification has the least amount of miles and includes only the Allegheny River. However, because of the size of the Allegheny River, it provides a significant amount of habitat for a variety of game and non-game fish and aquatic TES species. Game fish include species such as smallmouth bass, walleye, muskellunge, and catfish, as well as a quality trout fishery in the section downstream of Kinzua Dam to Warren.

Reservoirs and impoundments

The ANF has numerous, smaller impoundments distributed across the forest that provide fish habitat for warm-water species, with the exception of Twin Lakes which is cold enough to support a catchable trout fishery. Most impoundments support populations of warm-water species such as largemouth bass, sunfish, yellow perch, and bullhead. These impoundments were constructed, and are primarily managed for waterfowl propagation, and thus were not designed with fisheries as a primary objective. The exception is Twin Lakes which was constructed for recreational purposes. Due to the shallow nature of a majority of these, they are acidic and can only support limited, stunted, or no fish populations at all.

The few impoundments that do provide better habitat and support catchable populations of a variety of game fish include the largest Buzzard Swamp pond, Ridgway Reservoir, Tionesta Lake, and the Allegheny Reservoir. These bodies of water are larger and deeper and can support quality fisheries that include walleye, smallmouth bass, largemouth bass, yellow perch, muskellunge, northern pike, crappie, among others. Two current state record fish, the northern pike and walleye, were taken from the Allegheny Reservoir.

Fish habitat improvement has been an ongoing effort on the Allegheny Reservoir since the late 1980s. In cooperation with numerous volunteers, U.S. Army Corps of Engineers, and the Pennsylvania Fish and Boat Commission, a variety of structures have been placed into the reservoir each year in an effort to provide cover and suitable spawning habitat. Monitoring of these structures has shown that several different species are using these structures, some in large abundance. Fish habitat improvement in smaller impoundments has not been a focus of the ANF since water quality in most of them is the limiting factor to healthy fish and aquatic species populations.

Habitat indicator 3: Changes in habitat patterns on the landscape affecting late structural patch size and habitats with less human disturbance (remote habitats)

Besides the quantity and composition of habitats, the spatial and temporal arrangement of habitats on the landscape is important for maintaining viable populations of plant and animal species. Habitat for reproduction, foraging, resting, cover, and dispersal should be provided at a variety of scales across time and space (Morrison *et al.* 1992). To ensure species viability, the Forest Service is mandated to provide habitat that is “well distributed so that individuals can interact with others in the planning area.” (36 CFR 219.19). The Appalachia Regional Forest Stewardship standard (approved by the U.S. Forest Stewardship Council) recognizes the need for the spatial arrangement of habitats by specifically addressing habitat connectivity across the landscape (Forest Stewardship Council – US 2005).

Large blocks of older forests are declining in the Mid-Atlantic Region, a habitat essential to an entire guild of forest interior dwelling birds (PGC and PFBC 2005 pg. 11-9). Brauning (1992) identifies 42 bird species found on the ANF that prefer forest interior habitat and of these, 22 species are considered obligates of large forest blocks. Although forest area has increased in PA in the past century, incursions of human development in the form of openings and roads can decrease potential habitat for species that prefer or require large blocks of relatively undisturbed habitat (Goodrich *et al.* 2003, PGC and PFBC 2005 pg 12-20). The importance of these large contiguous tracts of high quality forest habitat as “source” habitats for area-sensitive species is emphasized in Pennsylvania’s Comprehensive Wildlife Conservation Strategy (PGC and PFBC 2005 pg 12-25). Conservation of highly productive “source” populations may be essential to maintaining viable populations throughout the entire region. Keller *et al.* (2003) recommends that land managers maintain a large core area of mature forests while providing small clearcuts and seed-tree cuts on the periphery.

Not all scientists agree that “landscape corridors” are beneficial to wildlife (Simberloff *et al.* 1992). However, McKenzie (1995) and Fischer and O’Neil (1997) provide important criteria to consider when designing a landscape corridor system, including: (1) developing clearly stated objectives, (2) examining the temporal and

spatial context, (3) emphasizing obtaining data on the spatial needs of species, and (4) addressing corridor management and restoration issues.

Spatially managing landscape patterns involves the consideration of the following 3 units (Lindenmayer and Franklin 2002):

1. Patches – non-linear blocks or relatively homogeneous habitat. Examples of patches on the ANF include the Hickory Creek Wilderness, the National Recreation Area, and Tionesta Scenic and Research Natural Areas. These patches are sometimes referred to as core areas.
2. Corridors – linear patches that usually differ from the “patch type” on either side of the corridor and which connect to the patches.
3. Matrix – the dominant “patch type” in a landscape. For example, the matrix on the ANF could be described as a predominantly mature forest interspersed with young even-age stands with an extensive road and trail network with variable intensities of oil and gas development.

Morrison *et al.* (1992) state that landscape design should:

1. Be objective and location specific, and
2. Ensure that patches are accessible throughout the landscape to species most habitat specific and to those with lowest vagility.

To address these landscape design criteria, species with viability concerns were grouped by broad primary habitats that could be delineated at the landscape scale. (For the specific habitat needs of each species with viability concerns see Appendix E). The landscape design of connecting core areas (MAs. 5, 7.2, 8.2, 8.3, and 8.5) using late structural linkages (MA 2.2) emphasizes a spatial and temporal habitat arrangement for the 22 species with viability concerns that utilize primarily mid-late structural forests and, secondarily the 15 species that utilize riparian/wetland habitats.

The core area/landscape linkage design uses the locations of the 1986 Forest Plan management areas as a starting point. Since the forest matrix will continue to experience increased oil and gas development, road and trail development, and expansion of utility rights-of-way, linkages between core areas are an important consideration in the landscape design. Modifying the current location of MA 6.1 to increase patch size and habitat connectivity became the focus of this landscape design effort.

Accurate information for the distribution of species and communities at a variety of scales is essential to designing landscape patterns (Morrison *et al.* 1992). Lands that would complement the ecological values of the proposed core areas were identified as late structural linkages. Information considered in the spatial design included:

- The current location of MA. 6.1
- The location of unroaded and roadless areas (identified in the Forestwide Roads Analysis)

- The location of raptor concentration areas (with an emphasis on goshawks) or preferred habitat utilized by landscape level species.
- The location of rattle snake dens, bat caves, and other unique habitat features
- The documented locations of Northern flying squirrels, Allegheny woodrats, Yellow-bellied flycatchers, and other species with viability concerns
- The location of late structural habitats identified in prior project analyses
- The location of Exceptional Value watersheds, Wilderness Trout streams, and Class A trout streams
- The results of a fragmentation computer model
- The diversity of forest types and the ecological land types (ELTs) including aspect and slope position.
- The location of high concentrations of oil and gas development.

Core forest habitat

Second only to the lack of regeneration, encroachment of development and roads is the second most serious threat facing forest quality in Pennsylvania (Goodrich *et al.* 2003). In an effort to identify tracts of forest that have little disturbance from roads and motorized trails, (and thus provide habitat for species that are adversely effected by human disturbance) the ANF identified forested tracks on NFS lands that occur greater than ¼ mile from existing classified roads (USDA FS 2003b). The larger tracks of undisturbed forest are identified as core habitat (Table 3-45). While many forest interior species will successfully utilize forest land within the ¼ mile buffer, information presented in Table 3-45 provides a relative measure of some of the most undisturbed habitat on the ANF.

Table 3-45. Core forested areas on National Forest System lands that occur greater than ¼ mile from existing classified roads.

Core Size (Acre range)	Total Acres	# of Sites	% of Forest Service Lands
5000-10,000	14,713	2	2.8
1000-5000	33,919	17	6.5
500-1000	12,117	18	2.3
<500	44,027	950	8.4
Total	104,776	987	20.1

(adapted from USDA FS 2003). Core areas= large patches of homogeneous habitat

Remote habitat

Remote habitats are areas where human disturbance is minimal. Species that are sensitive to human disturbance survive and reproduce better in these remote habitats. One method for identifying remote habitats across the landscape is to identify large unroaded areas. The Forest-wide Roads Analysis (USDA FS 2003b) identified 37 unroaded areas greater than 500 acres. All 37 areas were evaluated for 6 wildlife criteria, resulting in 8 areas with a wildlife index of 26 or greater (USDA FS 2003b). These 8 areas (33,000 acres) are believed to be the highest quality remote habitats on the ANF and include Allegheny Front, Clarion River, Cornplanter, Hickory Creek Wilderness, Tracy Ridge, Morrison Run, Indian Run (recently referred to as Chestnut Ridge), and Steck Run. Depending upon which Management Area each of these 8 remote habitats is located in, some will remain unroaded while new Forest Service road construction may occur in others. During the summer of 2006, extensive oil and gas development in Morrison Run has reduced the quality of remote habitat.

Some wildlife species are sensitive to human disturbance. For example, great blue heron's nest in isolated areas away from human activities (Bent 1963). Timber rattlesnakes do best in areas where human-rattlesnake encounters are infrequent (Urban 2005). Declines in wood turtle populations show a strong correlation with increasing human activity (Garber and Burger 1995). Northern goshawks, red-shouldered hawks, and other raptors may abandon their nest if human disturbance escalates (Nelson and Titus 1989).

Habitat indicator 4: Amount and trend in habitat for management indicator species

Management indicator species (MIS) are used in concert with other indicators to gauge the effects of the alternatives on wildlife habitat in general. MIS are expected to reflect the effects of the LRMP on ecological communities of management interest. In revising the MIS list the emphasis has been placed on species that are closely associated with habitats of interest and species that can produce meaningful data about the effects of forest management activities on a few major communities of interest.

The selection of MIS and the rationale are provided in Table 3-46. The overall approach is to use a limited number of MIS considered to be of special importance for maintaining viable populations of native and desired non-native species in the planning area. By selecting a limited but appropriate set of management indicator species, resources for inventory and monitoring can be focused where needed.

Species that were utilized as indicators in the 1986 Forest Plan but will not remain as management indicators in this Plan Revision include: white-tailed deer, American woodcock, magnolia warbler, beaver, black-throated green warbler, hermit thrush, barred owl, great blue heron, ruffed grouse, red-shouldered hawk, yellow-bellied sapsucker, pileated woodpecker, brook trout, walleye, and small mouth bass.

Criteria used for selecting indicators emphasize:

- Species identified as ecologically important through the Species Viability process and through development of the alternatives for the LRMP.
- The availability of credible monitoring protocols.
- Those that can be effectively and efficiently monitored

Table 3-46. ANF management indicator species and selection rationale.

Management Indicator	Habitat Represented	Rationale for Selection
Timber Rattlesnake	Remote deciduous forests with minimal human disturbance	Indicator of critical den sites that meet criteria needed to support populations. These sites should be maintained to provide remote or well connected habitat where human disturbance is minimal including fewer roads and trails. Monitoring active dens and the number of individual snakes at dens (including males, females, and young of the year) will provide an indication of the quality of remoteness and the relative absence of human disturbances.
Northern Goshawk	Mid to Late structural mixed deciduous/ conifer forest	Indicator of mature mixed deciduous/conifer forest, often containing diverse landscape and structural conditions. Due to its sensitivity to disturbance, this species can be used assess disturbance related effects of management and it can be monitored by field surveys and banding of adults and young. Due to its preference for predominantly late structural forests, this species can be monitored to assess effects of timber harvest at both the site and landscape scale. Threats include increased human disturbance to nesting habitat and loss of conifer from future infestations of the hemlock woolly adelgid
Cerulean Warbler	Mid-late structural oak forest with some canopy gaps	Indicator of mature oak forest important for a diversity of game and non-game species. Can be monitored using point/count transects and analyzed using appropriate statistics. Threatened by the long term loss of oak and a reduction in mature forest suitable for nesting.
Aquatic Invertebrate Diversity and Relative Abundance	Aquatic habitat and water quality in ANF streams	Indicator of stream quality important for a diversity of fish, dragonflies, mussels and other aquatic species. Can be monitored using established protocols. Important for assessing the effectiveness of standards and guidelines to protect aquatic resources.
Mourning warbler	Early structural habitat	Indicator of early structural habitat that is utilized by early successional species for foraging, reproduction, or hiding cover, including many game species and declining early successional species with viability concerns. Can be monitored utilizing a tape call-back technique to evaluate effects of activities that create early structural habitat.

Northern goshawk

Habitat status and trends

Although the northern goshawk is relatively abundant and widespread (NatureServe 2006), Pennsylvania is on the edge of its range and records of this species were not common anywhere in State (Brauning 1992). Within Pennsylvania goshawk observations were concentrated in the northeast and northwest portions of the State and reports were most frequent within the Appalachian Plateau Province, which includes the ANF. Research in Pennsylvania (Kimmel and Yahner 1994) indicates that this species is expanding its range into suitable habitat into the southern half of Pennsylvania.

On the ANF the goshawk is considered an uncommon species and since 1986, 74 nests have been identified Forest-wide. Collectively these nests make up 43 distinct territories. Seven of these territories were known to be active between 1986 and 1990, 15 territories were documented as active between 1991 and 1999 and since 2000, 12 territories have been documented as active. Although the Forest appears to have provided relatively stable goshawk populations for the last 15 years, nest production has been down in the last two years. While weather and possibly West Nile Virus (Brinker *pers. comm.* 2006) are suspected, the exact reason(s) for this decline are unknown.

Preferred habitat and forest use

Within Pennsylvania, confirmed observations of nesting goshawks were correlated highly with the percentage of forest in each county (Kimmel and Yahner 1994, Roberson et al. 2003). Comparisons of landscape habitat surrounding these nests indicated that in the Northern Hardwood Region (which includes the ANF), goshawks selected nest sites with the following parameters; 1) extensive forest, 2) nest sites farther from medium and heavy duty roads, buildings and forest edges, 3) nest sites near the tops of plateaus and on relatively level ground and 4) nest sites with a mixed or coniferous forest component (Kimmel and Yahner 1994).

In order to identify suitable habitat and better evaluate potential effects, a GIS analysis of known nests was completed. This analysis looked at habitat conditions and relationships at two scales including an assessment of known nest sites (8-32 acres) and territories (500-1200 acres). This analysis supports many of the habitat preferences identified by Kimmel and Yahner (1994) and goshawks on the ANF; 1) select nest sites that contain 4-6 times more conifer and mixed conifer/hardwood forest, 2) prefer sites that occur on level ground, 3) select nest sites with greater amounts of mature forest and fewer openings 4) select territories that include a variety of forest types, age classes and small openings, and 5) select nest sites and territories that contain a greater density of trails than is available across the landscape

Although lower standard roads are commonly found in close proximity to nests and within territories, high use roads are avoided and 90 percent of all roads within 300 ft. of a nest are closed to public access during the breeding season. Also goshawks selected unroaded areas at a higher frequency than their availability at both scales. While preferred habitat is characterized by

a combination of early, mid and late structural conditions, 96 percent of known nests and 91 percent of known territories are characterized by mid-late structural forest.

Landscape considerations

Based on results of habitat use and availability comparisons at different scales, Kimmel and Yahner (1994) suggested that goshawks select an area that is extensively forested, has little human disturbance and adequate prey habitat. Conifer was the most important landscape variable and Kimmel and Yahner (1994) suggested that the amount of conifer related to potential foraging habitat and the availability of foraging habitat may influence nest site selection at both the site and landscape scale. Other landscape features that may have been important to habitat selection by goshawks in Pennsylvania included the amount and distribution of stands of different size classes and canopy closure (Kimmel and Yahner 1994).

Presently 4 percent, 17 percent and 79 percent of known goshawk territories occur in Landscape Codes 1-3 respectively and the high percentage of occupied habitat in landscape code three, in part reflects its preference for predominantly forested but diverse landscapes preferred for foraging. The reduced use of landscape code 1, may in part be due to the larger oak component on these lands and the tendency for goshawks to less frequently utilize oak in the northern hardwood forests of Pennsylvania (Kimmel and Yahner 1994). Also plateau sites within landscape code 1 lands generally have less conifer, which is preferred by goshawks.

Forest population

Using nest data collected from the northern hardwood region including nests on the ANF, Kimmel and Yahner (1994) identified a minimum and ecological nesting density of 1.17 and 1.44 nests/100 km² of forest. Using these estimates, the ANF could expect to support between 23 and 29 goshawk pairs Forest-wide. Goshawk nests have been monitored on the Forest for over 20 years and this data, as well as that reported by Kimmel and Yahner (1994) represents the best scientific information available at this time.

Management emphasis

Management emphasis for the northern goshawk includes the following:

- Providing the habitat conditions necessary to maintain a minimum of 45 potential territories
- Maintaining >70 percent forest cover on National Forest System Lands.
- Manage suitable goshawk habitat at the landscape level to provide desired foraging and nest site conditions
- Protect active goshawk nests and maintain preferred structural conditions within active territories.
- Identify area requirements and continue to refine and identify landscape and site characteristics preferred by the northern goshawk

- Work with research and in-service and out-service partners to reduce risks from the HWA.

Cerulean warbler

Habitat status and trends

The cerulean warbler breeds from New York State and the Great Lakes States south to the central and southeastern United States. Although the range of this species has expanded, particularly in the Northeast (NatureServe 2006), it is one of the fastest declining songbirds in North America. The cerulean warbler has a status of threatened, endangered or is identified as a species of concern in 15 states, is a high priority species in Partners In Flight (PIF) and was petitioned for federal protection under the Endangered Species Act in 2002, although in December 2006, the USFWS determined that listing was not warranted (Federal Register 2006). In Pennsylvania it is listed as apparently secure and statewide breeding bird records indicate that this species is still broadly distributed in the western third of the State, particularly in the southwest (Brauning 1992).

In the PIF Allegheny Plateau region, the cerulean warbler is showing a non-significant decline of 3.2 percent per year, but it is showing a significant survey wide decline of 4 percent (Sauer *et al.* 2005). The largest known present-day populations within the Allegheny Plateau Region are in the Allegany State Park area of New York (which adjoins the ANF), the Delaware River drainage of northeastern Pennsylvania, and in the Lake Metro parks area near Cleveland, Ohio (Rosenberg *et al.* 2000). The Allegheny Plateau Region and this physiographic area shares a high responsibility for the long-term sustainability of the cerulean warbler (Partners in Flight 2001).

Threats

Anthropogenic land use changes are probably the primary cause of population declines for cerulean warblers (Robbins *et al.* 1989, Rodewald 2004) and fragmentation of mature, deciduous forest on its breeding grounds, particularly along stream valleys, is cited as an important contributing factor (Hamel 2000). While cerulean warblers are considered area sensitive, the minimum patch size varies (Hamel 2000) and this variation in area requirements is likely a consequence of different amounts of regional forest cover and land uses (Rodewald 2004). Nevertheless, maintaining large blocks of mature forest habitat is necessary to provide habitat for this species (NatureServe 2006).

Preferred habitat

Cerulean warblers nest in a variety of tree species (Hamel 2006, *in press*) and prefer stands that contain sawtimber size trees (>11' d.b.h.). In addition to large diameter trees, stands that contain tall trees (>60'), complex vertical structure and more heterogeneous stand conditions are also preferred (Hamel 2006, *in press*). Typically cerulean warblers choose to place their nest high in the canopy, closer to the outer edge of the canopy and away from the bole, suggesting that nest trees may have been opened up and experienced full sunlight at some point in time (Hamel and Rosenberg 2006, *in press*). Robbins *et al.* (1989) studied 469 forest sites in Maryland and

adjacent states and found the occurrence of cerulean warblers to be associated with large tracts of mature, semi-open deciduous forest. He also found that their distribution was positively correlated with the area of the forest and basal area and negatively correlated with the percent canopy cover by coniferous trees.

Although research has shown that cerulean warbler use is often associated with canopy gaps and more open canopy conditions (Rodewald 2004, Stoleson 2004, Stoleson *pers. comm.*, 2005a., Robbins *et al.* 1998, Nicholson 2004, Hunter *et al.* 2001, Wood *et al.* 2005), this is not consistent across its range and some researchers (Jones 2000), do not associate the birds with canopy gaps (Hamel 2006, *in press*). On the ANF, cerulean warblers have been found to be associated with canopy disturbances and occur at higher densities in areas with more open canopy conditions and in portions of the stand where there are canopy breaks (Stoleson *pers. comm.* 2005a). Other key structural features preferred on the Forest include increasing levels of ground cover and vertical structure, close proximity to water, multiple oak species, and reduced levels of maple.

Because the cerulean warbler utilizes sites with specific structural conditions and considering stand stocking is an accepted measure of assessing site specific stand conditions, recent research has utilized stocking to assess site specific habitat utilized by the cerulean warbler. Like other elements of cerulean warbler breeding habitat, stocking varies somewhat across its range. In the Mississippi Valley, nests selected at two of the three study sites were in stands that were between 80 percent and 98 percent stocked, whereas stocking was greater than 120 percent at the third study site, although these sites were not oak stands, but were cottonwood dominated bottomlands with an oak component. In southern Indiana, birds were detected in stands that were between 65 percent and 110 percent stocked and pairs were found at sites less than 70 percent, whereas in southern Ohio, cerulean warblers were found in stands between 60 percent and 90 percent stocked, with higher densities in stands <70 percent stocked (Hamel 2006, *in press*). Within stands monitored on the ANF, higher densities of cerulean warblers were found in stands between 60 percent and 84 percent stocking and no birds were found in stands greater than 100 percent stocked (Stoleson *pers. comm.* 2005a). This research suggests that on the ANF, cerulean warblers prefer stands less than 100 percent stocked and that higher densities occur in more open stands, or stands that are between 50 percent and 75 percent stocked (Stoleson *pers. comm.* 2005a).

Landscape considerations

Because the cerulean warbler is considered a forest interior species, tract size is an important consideration and research suggests that patch size and the proportion of forest in the landscape affects habitat suitability (Twedt *et al.* 2006). Tract size varies across its range and while it is confined to larger tracts (>4,000 ha) of land in the southwest portion (10,000 acres) of its range, it occupies a much wider array of tract sizes in the north and northeast (Rosenberg *et al.* 2000 and Weakland and Wood 2005). The amount of forest cover was also found to be important by Rodewald (2004) and in her Pennsylvania study she found that birds were positively associated with a high proportion of forest area within 0.6 miles. Because over 90 percent of the ANF is forested, and considering mature forest conditions predominate, the ANF landscape provides preferred cerulean warbler habitat.

Forest-wide habitat and use

Between 1991 and 2005, cerulean warblers were found on 26 percent of the sites surveyed on the ANF which included oak and non-oak sites, riparian and plateau sites, old-growth and second-growth sites, and sites with and without timber harvest. Eighty-nine singing males were documented during this effort, including 27 on non-Federal lands and 62 on the ANF. Of those documented on the ANF, all but three occurred in the oak forest type or in upland hardwood forest that contained an oak component. The three occurrences outside oak were in sycamore trees on wilderness islands on the Allegheny River. While its preference for forest type varies across its range, on the ANF cerulean warbler has only been documented on sites that contain an oak component or in riverine habitat. As a result, preferred cerulean warbler habitat is restricted primarily to these two communities.

Suitable landscape habitat includes all seventh order watersheds that contain an oak component and riverine habitat, which cumulatively comprises approximately 223,000 acres or 44 percent of the ANF. Although the amount preferred nesting habitat is much less and presently only 75,000 acres occurs as mature typed oak and riverine forest that is considered preferred nesting habitat. Because research on the Forest indicates that cerulean warblers prefer to nest in stands where more open canopy conditions occur, existing mature oak/riverine habitat was broken down by stocking levels and is presented in Table 3-47. Currently, approximately 12 percent of the Forest provides preferred cerulean warbler nesting habitat and of this, it is estimated that approximately 79 percent has stocking levels that might be utilized for nesting (i.e., <100 %).

The landscape condition that contains preferred nesting habitat varies somewhat and predominately forested landscapes with little early structural habitat (Codes 1 and 2) comprises 65 percent of the preferred nesting habitat, whereas landscape code 3, or predominately forested landscapes with a mix of early and mid structural forest contains 38 percent of the preferred habitat. Landscape code 5, which includes riparian/riverine habitat contains approximately 2 percent of the preferred nesting habitat.

In an effort to estimate potential breeding pairs that could be found on the ANF, Stoleson (*pers. comm.* 2005a) compared survey data collected in the oak forest community on the ANF, with that provided by Baird (1990) in Allegany State Park and came up with similar numbers. Based on this comparison and the present availability of oak habitat, it is estimated that the ANF could support between 500 and 1500 pairs of cerulean warblers, with higher densities occurring on sites that provide optimum habitat conditions.

Table 3-47. Preferred cerulean warbler nesting habitat

Use	Stand Condition	Acres	% of the Forest	% of Preferred Habitat
Suitable - No documented use	Mature Oak/Riverine >100% stocked	16,000	3	21
Suitable - Low density use	Mature Oak/Riverine 75-100% stocked	40,200	8	53
Optimum - high density use	Mature oak/Riverine 60-75% stocked	19,800	4	26

Management emphasis

- Minimize the loss of the oak forest community
- Maintain >70 percent of the oak forest type as suitable cerulean warbler nest habitat (i.e. >50 years of age)
- Provide habitat conditions capable of supporting a minimum of 1200 pairs of cerulean warblers

Timber rattlesnake**Habitat status and trends**

The timber rattlesnake is considered uncommon to rare in much of Pennsylvania. While sizable populations are believed to still occur in the Appalachian Mountains from Pennsylvania through the Virginias, across eastern Kentucky and Tennessee to northeastern Alabama, (NatureServe 2004), the species is still declining or has been extirpated in all northeastern states. NatureServe (2004) suggested denning populations in New York have been reduced by 50 to 75 percent of their historical numbers. Martin (NatureServe 2004) stated that long-term observer's feel that most dens are at 15 percent to 20 percent levels compared to 40 years ago.

Most recent information indicates that the rattlesnake populations have declined throughout their range in recent decades and continue to decline. The timber rattlesnake is a candidate for being listed as threatened in Pennsylvania (Keystone Wild Notes 2005).

Preferred habitat

In the Northeast, this species inhabits mountainous or hilly deciduous or mixed deciduous-coniferous forest, often with rocky outcroppings, steep ledges, and rock slides (NatureServe 2004).

This snake is at home in timber-covered terrain, especially that of second-growth woodland where an abundance of rodents may be found. It likes wooded hillsides accented with rock outcrops where ledges of stone might provide opportunities for basking. When winter sets in, fissures in these places provide passage to deep dens for hibernation. Slopes with a southern exposure are preferred.

Open forest edges, openings, meadows and open shrub-land edges have been noted to be used most frequently by gravid females. Non-gravid females and males will pass through these areas but do not remain in them for long periods of time. Dens occur at elevations of up to about 5,000 feet in the southern Appalachians, 2,200 feet in New England, and about 1,300 feet in northeastern New York, Wisconsin, and Minnesota; individuals may range between elevations in the summer (NatureServe 2004). Forest structure is based on the timber rattlesnake preference for second growth forest interspersed with foraging and basking areas. Decayed logs provide areas for timber rattlesnakes to escape hot summer days. Snakes use other downed logs to "ambush" small mammals as they run across them.

Habitat indicator

Dens - Several factors pertaining to timber rattlesnake biology and life history, indicates that denning habitat may be the limiting factor in supporting viable populations of this species. Dens consist of rocky crevices, outcrops or rocky slopes most often on southern exposures that occur near forested openings. Dens that are located in somewhat remote and/or unroaded areas add an additional level of protection to population viability. The den site is the focal point of rattlesnake activity. Rattlesnakes exhibit a high fidelity to their den site returning each year to winter inside the den (Amato and Rosenthal 2002).

Basking habitat – Open forest edges, meadows and open shrub-land edges and exposed rock outcrops. This habitat type is used most frequently in and near the den site and is vital to gestation of young. Talus slopes, rocky ledges and outcrops, and boulder fields with open, primarily southern-facing exposures also create conditions ideal for basking.

Second growth forest – These forests can be a mix of conifer and various hardwoods and are interspersed with openings. For foraging rattlesnakes prefer upland forested areas where they forage for small mammals like mice and chipmunks.

Mourning warbler

Habitat status and trends

The mourning warbler breeds from Alberta and North Dakota to southern Canada and south to northeastern U.S. and the higher Appalachians to West Virginia. In Pennsylvania mourning warbler nesting was reported in 19 percent of the survey blocks statewide. Breeding bird atlas volunteers found mourning warblers scattered across much of northern Pennsylvania but most frequently in the glaciated section, where it was recorded in 25 percent of the blocks, in the Allegheny High Plateau Section (15% of the blocks), which includes the ANF and the eastern lakes section (11%) (Brauning 1992).

Preferred habitat

Mourning warblers nest within the full range of elevations, but in Pennsylvania are largely restricted to the northern hardwood forest (Brauning 1992). Habitat includes disturbed second growth, deciduous, shrubby early successional growth, dense undergrowth in open woods and occasionally in partially open coniferous and deciduous woodlands with herbaceous and shrub understories (Pitocchelli 1993).

Nesting habitat includes stands of dense saplings and shrubs (Pough 1949 p.185) and primary requirements are a partially open canopy and good mixture of herbaceous and shrubby ground cover (Cox 1960). In New England, mourning warblers depend on activities that create early successional habitat (DeGraaf and Yamasaki (2001) and in northern Pennsylvania the highest densities occurred in areas that have been clearcut (www. Great Lakes Bird Conservation).

Due to its dependence on dense low growing woody vegetation, use of disturbed habitats is temporary and in New England it first appears in regenerated areas 2 years after harvest, became abundant in 5 years and began to decline after 7-10 years (DeGraaf 1991). This is consistent with monitoring in the ANF which indicates that the highest densities occur in stands less than 10 years of age and it is generally absent in stands 20 years of age or older. On the ANF this species has also been documented on sites that have received a shelterwood harvest (Scott Stoleson *pers. comm.* 2006b) and although regenerated areas contain higher densities, mature forest stands with open understories and small canopy gaps that permit establishment of dense, low growing woody vegetation provide suitable nesting habitat.

Landscape considerations

Because of the increased amount of early structural habitat provided, those lands identified as landscape codes 3 and 4, which comprise 67 percent of the ANF would be preferred and it would be expected that higher densities of the mourning warbler would occur on these lands. However, because this species utilizes small gaps in the forest canopy, the entire ANF landscape would provide potentially suitable habitat. Additionally, suitable habitat would also be expected to occur along or adjacent to many of the roads or utility rights-of-way (ROWs) that occur across the ANF landscape.

Habitat indicator

Due to their dependence on shrubs and dense woody vegetation, the mourning warbler is an indicator of early successional vegetation and because they utilize small gaps as well as large disturbed areas, they can be used to monitor effects of both even and uneven-aged timber harvest. A tape call-playback technique will be used to monitor singing males and determine densities in areas that receive active management, in areas where the canopy has been opened up though naturally occurring disturbances such as blowdown and in areas that have been affected by defoliation from native or non-native species.

Management emphasis

- Maintain a minimum of 5 percent of the Forest in early structural forest and shrub habitat capable of supporting mourning warblers
- Increase monitoring of shrub nesting birds, with emphasis along utility corridors and in areas managed through timber harvest
- Maintain or improve the distribution of non-forested shrub habitat

Aquatic invertebrates

Habitat status and trends

Commonly referred to as aquatic insects, this group of invertebrates occurs in just about any stream or impoundment where water quality conditions and habitat conditions are suitable. Within the ANF, this includes several hundred miles of cold-water streams, including small headwater streams to larger streams and rivers that provide suitable habitat. Pennsylvania

Department of Environmental Protection recently completed aquatic insect surveys on named streams within the ANF as part of a State-wide effort to assess stream quality. The results from this effort indicate all streams surveyed provide suitable aquatic habitat except for three. Two of the three streams (Table 3-6) are affected by natural causes, while the third is affected by non-Forest Service activities.

Preferred habitat

Depending on the group of aquatic invertebrates, some prefer flowing water over rocky cobble-size substrates with low embeddedness, while others prefer slow, back-water areas or pools in streams. Good water quality is also an important feature for supporting a diverse and abundant population. The focus for assessing aquatic insects in ANF streams will be in flowing water of streams where protocols for conducting surveys have been established.

Habitat indicator

Aquatic invertebrates are indicators of stream habitat quality, including substrate and water quality. Some invertebrates are less tolerant to altered stream conditions while others are more tolerant of disturbance. Depending on which invertebrates are collected will determine the habitat condition.

Management emphasis

Contribute to water quality and physical habitat conditions that provide for the maintenance and/or enhancement of aquatic invertebrates.

Habitat indicator 5: Amount and trends in habitat for game species

Black bear populations have increased across the ANF and habitat conditions are considered good. Black bears will utilize dense seedling/sapling habitat as escape/hiding cover particularly during hunting season. Black berries, found in early structural habitats are a favorite late summer food. Acorns and beech nuts are consumed in large quantities in the fall when available. A diverse forest in terms of composition and structure provides a variety of food sources for black bears (Ternet 2003).

After many decades of high deer populations, recent efforts to reduce the deer herd have been successful. Although understory habitat conditions have not fully recovered, progress is being made to restore habitat, improve deer condition and population structure (size, buck/doe ratio, doe/fawn ratio) while maintaining a quality hunting experience. Early structural habitat provides abundant browse for deer. Oaks, black cherry, and beech provide important fall food sources.

Turkey populations are increasing slightly and habitat conditions are good in most areas. Turkeys utilize early structural habitat for nesting and mid to late structural habitat for feeding and roosting. Like many other game species, oaks provide an important food source. Wildlife opening construction and maintenance provide spring and summer foraging habitat and summer brood rearing habitat.

Grouse and woodcock populations fluctuate and quality hunting opportunities are variable. Currently about 10 percent of ANF lands are in early structural habitat utilized by these game birds. Management Area 1.0 has an

emphasis on short rotation forests specifically for ruffed grouse. Currently about 8,000 acres are in MA 1.0. Wildlife openings provide summer brood rearing habitat for grouse. Woodcock will utilize openings near alder, willow, and crab apple thickets where soils are moist and deep. Both of these game birds utilize old farm habitats where shrubs, openings, and thickets are present.

The Allegheny Reservoir provides suitable habitat for several game fish. Among these are two of the most highly sought after fish by anglers, walleye and smallmouth bass. Northern pike, muskellunge and yellow perch are also species that anglers seek. Populations of these and other species in the reservoir can, and do, fluctuate from year to year. Habitat exists in the form of fallen trees, rocky drop-offs, rocky points, and some shallow bays. Aquatic vegetation is a habitat condition that is lacking in the reservoir due to the fluctuating water levels by Kinzua Dam.

The ANF is dominated by cold-water streams that support brook and some brown trout populations. Habitat conditions are generally suitable for these species, with forested and well-shaded riparian areas and suitable substrate conditions for spawning. The amount of pools is less than desired in most streams due to a lack of large trees. Water quality is generally suitable for trout, but where pH levels are low (acidic), trout occur in low numbers or not at all.

Substantial investments have been made in habitat enhancements, many of which directly benefit game species. Most large decadent aspen stands have been regenerated to benefit grouse and woodcock. Most small impoundments have been retrofitted with Clemson beaver excluders and new water control structures to benefit waterfowl and shorebirds. Numerous grass and shrub openings have been constructed to benefit turkeys, grouse and bears. Fish structures have been placed in the Allegheny Reservoir to benefit game and non-game fish.

Habitat indicator 6: Species with viability concerns

The National Forest Management Act and its implementing regulations require national forests to preserve and enhance the diversity of plant and animal communities to meet multiple use objectives based on the suitability and capability of the land. The regulations further require maintenance of viable populations of existing native and desirable non-native species (16 U.S.C. 1600(6)(g)(3)(B); 36 CFR 219.19, 219.26, and 219.27(g)).

The viability process used a multi-scale analysis to ensure that the needs of all species are met at both the landscape (coarse filter) and site levels (fine filter). This approach is well established in conservation biology literature and ensures adequate representation of ecological land units, natural disturbance regimes and historical range of variation required at the landscape or coarse filter scale, as well as a fine filter assessment of individual, rare or specialized species needs. A combination of coarse and fine filter considerations were used to 1) evaluate species specific needs, 2) identify species and habitats that may be at risk, 3) identify conservation recommendations, 4) identify Forest objectives and design criteria and 5) evaluate direct, indirect and cumulative effects.

The fine-filter analysis focuses on maintaining viable populations of individual species that are identified as having potential viability concerns. The process for determining which species have viability concerns is outlined in Appendix E. Fine-filter analysis can serve as verification that the coarse-filter component is working, as well as a safety net to identify species-specific conservation actions that are necessary for maintaining viable populations of species that are not adequately conserved by the coarse-filter approach (Haufler *et al.* 1999).

Starting with the Western Pennsylvania Conservancy Natural Heritage list of species for Pennsylvania, more than 300 animal species and 1,200 plant species known to occur on the ANF were identified. This subset of species was screened using a decision tree using the best available data. This final list of species was developed in consultation with species experts associated with the various technical committees of the Pennsylvania Biological Survey.

A total of 78 species were identified with potential viability concerns for the ANF (Table 3-48). Of the 78 species with viability concerns, six species are currently listed as Federally threatened or endangered, two are Federal candidates, and 60 are Regional Forester Sensitive Species (includes the two Federal candidates as well). A detailed description of the life history, distribution, and habitat requirements for the following species is contained in the planning record – Species Viability Evaluation Section as species long forms, a Biological Assessment, a Biological Evaluation, and Ecological Context Report.

Table 3-48. Species with viability concern on the Allegheny National Forest

Taxa	Common Name	Scientific Name
Amphibian	Four-toed salamander	<i>Hemidactylium scutatum</i>
Amphibian	Jefferson salamander	<i>Ambystoma jeffersonianum</i>
Aquatic Insect	Green-faced clubtail	<i>Gomphus viridifrons</i>
Aquatic Insect	Harpoon clubtail	<i>Gomphus desertus</i>
Aquatic Insect	Maine snaketail	<i>Ophiogomphus mainensis</i>
Aquatic Insect	Midland clubtail	<i>Gomphus fraternus</i>
Aquatic Insect	Mustached clubtail	<i>Gomphus adelphus</i>
Aquatic Insect	Ocellated darner	<i>Boyeria grafiana</i>
Aquatic Insect	Rapids clubtail	<i>Gomphus quadricolor</i>
Aquatic Insect	Resolute damselfly	<i>Coenagrion resolutum</i>
Aquatic Insect	Ski-tailed emerald	<i>Somatochlora elongata</i>
Aquatic Insect	Uhler's sun dragon	<i>Helocordulia uhleri</i>
Aquatic Insect	Zebra clubtail	<i>Stylurus scudderi</i>
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>
Bird	Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Bird	Cerulean Warbler	<i>Dendroica cerulea</i>
Bird	Golden winged warbler	<i>Vermivora chrysoptera</i>
Bird	Great blue heron	<i>Ardea herodias</i>
Bird	Henslow's sparrow	<i>Ammodramus henslowii</i>
Bird	Northern goshawk	<i>Accipiter gentilis</i>
Bird	Osprey	<i>Pandion haliaetus</i>
Bird	Raven	<i>Corvus corax</i>
Bird	Red-shouldered hawk	<i>Buteo lineatus</i>

Taxa	Common Name	Scientific Name
Bird	Swainson's thrush	<i>Catharus ustulatus</i>
Bird	Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>
Fish	Bluebreast darter	<i>Etheostoma camurum</i>
Fish	Burbot	<i>Lota lota</i>
Fish	Channel darter	<i>Percina copelandi</i>
Fish	Gilt darter	<i>Percina evides</i>
Fish	Gravel chub	<i>Erimystax punctata</i>
Fish	Longhead darter	<i>Percina macrocephala</i>
Fish	Mountain brook lamprey	<i>Ichthyomyzon greeleyi</i>
Fish	Mountain madtom	<i>Noturus eleutherus</i>
Fish	Northern madtom	<i>Noturus stigmosus</i>
Fish	Spotted darter	<i>Etheostoma maculatum</i>
Fish	Tippecanoe darter	<i>Etheostoma tippecanoe</i>
Mammal	Indiana Bat	<i>Myotis sodalis</i>
Mammal	Northern flying squirrel	<i>Glaucomys sabrinus macrotic</i>
Mollusk	Clubshell	<i>Pleurobema clava</i>
Mollusk	Creek heelsplitter	<i>Lasmigona compressa</i>
Mollusk	Long-solid	<i>Fusconaia subrotundra</i>
Mollusk	Northern Riffleshell	<i>Epioblasma torulosa rangiana</i>
Mollusk	Rabbitsfoot	<i>Quadrula cylindrica</i>
Mollusk	Rainbow	<i>Villosa iris</i>
Mollusk	Rayed-bean	<i>Villosa fabalis</i>
Mollusk	Round pigtoe	<i>Pleurobema sintoxia</i>
Mollusk	Sheepnose	<i>Plethobasis cyphus</i>
Mollusk	Snuffbox	<i>Epioblasma triquetra</i>
Mollusk	Threeeridge	<i>Amblema plicata</i>
Mollusk	Wabash pigtoe	<i>Fusconaia flava</i>
Mollusk	White heelsplitter	<i>Lasmigona complanata</i>
Plant	American fever-few	<i>Parthenium integrifolium</i>
Plant	American ginseng	<i>Panax quinquefolius</i>
Plant	Canada yew	<i>Taxus canadensis</i>
Plant	Bartram shadbush	<i>Amelanchier bartramiana</i>
Plant	Boreal bog sedge	<i>Carex magellanica ssp. Irrigua</i>
Plant	Bristly black currant	<i>Ribes lacustre</i>
Plant	Butternut	<i>Juglans cinerea</i>

Taxa	Common Name	Scientific Name
Plant	Checkered rattlesnake plantain	<i>Goodyera tessellata</i>
Plant	Creeping Snowberry	<i>Gaultheria hispidula</i>
Plant	Hooker's orchid	<i>Platanthera hookeri</i>
Plant	Kidney-leaved twayblade	<i>Listera smallii</i>
Plant	Mountain starwort	<i>Stellaria borealis</i>
Plant	Mountain wood fern	<i>Dryopteris campyloptera</i>
Plant	Northeastern Bulrush	<i>Scirpus ancistrochaetus</i>
Plant	Queen-of-the-prairie	<i>Filipendula rubra</i>
Plant	Red currant	<i>Ribes triste</i>
Plant	Rough cotton-grass	<i>Eriophorum tenellum</i>
Plant	Small Whorled Pogonia	<i>Isotria medeoloides</i>
Plant	Stalked bulrush	<i>Scirpus pedicellatus</i>
Plant	Sweet-scented Indian plantain	<i>Hasteola suaveolens</i>
Plant	Threadrush	<i>Juncus filiformis</i>
Plant	White trout-lily	<i>Erythronium albidum</i>
Plant	Wiegand's sedge	<i>Carex wiegandii</i>
Reptile	Coal skink	<i>Eumeces anthracinus</i>
Reptile	Eastern Box turtle	<i>Terrapene carolina</i>
Reptile	Timber rattlesnake	<i>Crotalus horridus</i>
Reptile	Wood turtle	<i>Glyptemys insculpta</i>

Migratory birds

A list of migratory birds known to inhabit the ANF was developed as part of the Species Viability Evaluation and is provided in the project file. Migratory birds that occur on the ANF that were determined to have viability concerns were further analyzed as part of the species viability process. Guidelines were incorporated into the LRMP to conserve specific species or to mitigate impacts of specific management activities.

As part of a statewide effort to identify high priority habitats for birds, two Important Bird Areas were developed within the ANF by the Ornithological Technical Committee and Pennsylvania Audubon Society. These two areas encompass Tionesta Scenic and Research Natural Areas and East Hickory Creek watershed comprising about 13,000 acres. Yellow-bellied flycatchers and Cerulean warblers are two species of special emphasis.

Federally-listed threatened, endangered, and candidate species

The Indiana bat, bald eagle, clubshell, northern riffleshell, Small whorled pogonia, and northeastern bulrush are federally listed threatened and endangered species that occur or have high potential habitat on the ANF. The sheepsnose and rayed-bean are Federal candidate mussels. A detailed habitat description and life history for each of these species is provided in the Biological Evaluation. A brief summary for each of these species is provided below.

Indiana bat

Much of the forested habitat on the ANF contributes in some way towards maternity landscape/roost habitat and foraging habitat, however some acres provide more beneficial habitat conditions than others. Currently, more than 70 percent of the ANF is optimal foraging and roosting habitat and an additional 8 percent is suitable foraging and roosting habitat. Bat surveys have been conducted on the ANF since 1998 and during the last eight field seasons (1998-2005), a total of 311 sites have been surveyed for a total of 2,619 net nights. Only one male Indiana bat has been captured and released (Gannon and Blackburn 2002a). This capture occurred in 1998.

Bald eagle

Bald eagles generally nest near coastlines, rivers, large lakes or streams that support an adequate food supply and where human disturbance is limited. Pennsylvania's rivers, as well as Lake Erie, were a stronghold for nesting bald eagles, both historically and at the present time. In northwestern Pennsylvania, bald eagles nest in large trees near a body of water. Preferred nest trees tower above the adjacent hardwood canopy allowing unobstructive access to the nest while providing some concealment and shade. In 2005, bald eagle nests had been documented in 25 counties, or 37 percent of the counties in Pennsylvania and on the ANF approximately 47,000 acres or 9 percent of the Forest are considered primary bald eagle nesting habitat. This area includes all National Forest System lands within ½ mile of the Allegheny Reservoir, the Allegheny and Clarion Rivers and Tionesta Creek. Although there are other areas where eagle nesting may occur, due to the proximity to foraging habitat, these areas have the greatest potential for nesting.

Eagles forage along rivers, large streams, and lakes where there is an ample supply of fish and the best foraging and roosting habitat on the Forest occurs along the Allegheny Reservoir and the Allegheny River, although many of the larger streams on the ANF also provide suitable foraging habitat. In addition to the Allegheny River and Allegheny Reservoir, eagles have been observed foraging along Tionesta Creek, Salmon Creek, Kinzua Creek, the Clarion River, Millstone Creek, Big Mill Creek, Martin Run, and Willow Creek. Eagles also occasionally utilize the small impoundments distributed throughout the ANF and sightings have been made at Buzzard Swamp, Beaver Meadows, Twin Lakes and the Mead Run ponds. In total, approximately 23,000 acres or 4 percent of the Forest is considered primary bald eagle foraging and roosting habitat. Off the ANF, eagles have been observed along Brokenstraw Creek, Conewango Creek, and the upper Allegheny River in New York.

Ten bald eagle nests have been documented within the proclamation boundary since 1992 including four nests on side hills above the Allegheny Reservoir, four nests along the Allegheny River and two nests on side hills above Tionesta Creek. All nests are monitored annually and since the first nest on the ANF was located in 1992, 64 eagles have fledged from nests within the proclamation boundary. This level of nest success is consistent with that found in northwest Pennsylvania as a whole.

Clubshell and northern riffleshell

Suitable habitat for these mussels is provided in the Allegheny River within the ANF and populations of these endangered mussels have been documented from Warren down river for more than 30 miles. Recent surveys have documented that the largest reproducing concentration in the U.S. of both clubshell and northern riffleshell are now in the Allegheny River at Hunter Station (Villella and Smith 2002). This is outside the ANF proclamation boundary but in the Wild and Scenic section of the Allegheny River. Prior to the above survey, the largest concentration was recorded within the proclamation boundary of the ANF in the Allegheny River at W. Hickory Bridge (USGS 2000).

Clubshell and northern riffleshell abundance increases as you move downstream from just below Warren to Tionesta. The clubshell is far less abundant than the northern riffleshell based on USGS surveys.

Small whorled pogonia

Across its range, small whorled pogonia is found in several types of habitat. In Pennsylvania, this rare orchid occurs on dry oak sites, on benches or saddles, and near the beginning of intermittent drainages, usually on south or southeast facing slopes (USDI FWS 1992). In Maine and New Hampshire, botanists have found colonies along braided channels of vernal streams and in gullies up-slope from where streams arise in the water-sorted leaf litter along these streams (USDI FWS 1992). The orchid prefers highly acidic, nutrient poor soils. At several New England sites, an impermeable soil layer (fragipan) beneath the highly acidic soils blocks water from further percolation. In the past, habitat was described as “dry woodland.” Currently, the plant is known to occur on much more moist sites than previously indicated. In 1994, following discussions with the USFWS and P. Wiegman of the Western Pennsylvania Conservancy, the ANF defined suitable habitat for the species as mature or maturing forest conditions, topographic saddles and swales between ridges, slopes with benches and/or ephemeral streams, and sites with little or no understory and without dense fern.

Small whorled pogonia occurs in mixed deciduous/coniferous forests ranging in age from 30 to 80 years. The forest types can be variable, but are usually dominated by hardwoods such as beech, birch, maples, oaks, and hickory. Less often, it may grow under softwoods such as hemlock or white pine. The majority of small whorled pogonia sites share several common characteristics including a sparse to moderate ground cover in the microhabitat of the orchids (except when among ferns), a relatively open understory canopy, and a proximity to logging roads, streams, or other features that create long, persistent breaks in the forest canopy (Mehrhoff

1989). Shade may be important at sites where the small whorled pogonia no longer exists. Population declines may be attributed to canopies becoming denser and there is not enough light reaching the forest floor.

Typical overstory species associated with this orchid include white pine, red oak, white oak, black oak, red maple, eastern hemlock, American beech, and tulip poplar. A few ground layer species are associated with both the northern and southern parts of the species' range. These include partridgeberry (*Mitchella repens*), Indian cucumber root (*Medeola virginiana*), New York fern (*Dryopteris noveboracensis*), sweet low-bush blueberry (*Vaccinium augustifolium*), spicebush (*Lindera benzoin*), false ginseng (*Aralia nudicaulis*), and white snakeroot (*Eupatorium rugosum*).

With small populations occurring 15 miles to the west and 55 miles to the southeast, the ANF is within range of this orchid. The ANF possesses suitable overstory and understory vegetation, favorable topographic formations, physical features, and soil conditions similar to other habitats occupied by the plant. Mature or maturing stands of oak (species) or stands having a significant component of oak are currently considered areas of high potential habitat. The ANF contains approximately 100,000 to 150,000 acres of potentially suitable habitat (USDA FS 1998g).

Northeastern bulrush

Throughout its range, northeastern bulrush is found in open, tall herb-dominated wetlands. Often it grows at the water's edge, or in a few centimeters of water, but it may also be in fairly deep water (0.3-0.9 m) or away from standing water. In the southern part of its range, the most common habitat is sinkhole ponds, usually in sandstone. Water levels in these ponds tend to vary both with the season and from year to year. There are no known occurrences on the ANF. On-going county natural heritage inventories and the wetland rare plant survey conducted by WPC (1989) have not located any populations to date. The WPC will be surveying within the proclamation boundary during the 2006-2007 field season. Finding the species on the ANF would represent a significant range expansion. However, considering the recentness of the species description, the similarity to common species, and the number of new discoveries in the past 15 years, it would not be surprising to find on the ANF (S. Grund *pers. comm.* 2006)

Federal candidate species

Sheepnose and rayed-bean

Suitable habitat for both of these federal candidate species is provided in the Allegheny River. Habitat requirements are similar to the clubshell and northern riffleshell, however the population numbers for the sheepnose and rayed-bean are far less than the clubshell and northern riffleshell based on recent surveys conducted by USGS. Within the proclamation boundary and Wild and Scenic River section, the sheepnose has only been collected from between Tionesta and Oil City. For the rayed-bean, it has been collected at several locations of the upper Allegheny River, but never in any abundance.

Direct and indirect effects

Scope of the analysis

The scope of the analysis is primarily focused on the direct and indirect effects associated with the 506,000 acres of National Forest lands. Temporal analysis will address short-term effects through the second decade, and long-term effects through the sixth decade.

Introduction to effects

Effects are described as ecosystem level and species level effects. Ecosystem effects include an analysis of habitat structure, habitat composition, and habitat patterns across the landscape and an analysis of management indicator species. Species effects include an analysis of game species and species with viability concerns. A framework for the effects analysis is provided in Table 3-49. Alternatives are evaluated based on the same six indicators outlined in the previous section, Affected Environment: 1) habitat structure, 2) habitat composition, 3) habitat patterns, 4) habitat and populations of Management Indicator Species, 5) habitat for game species, and 6) habitat for species with viability concerns. Management activities that influence the habitat indicator are listed in Table 3-49. A list and the amount of management activities by alternative are contained in Chapter 2 (Table 2-2). This analysis assumes full implementation of the LRMP and its activities. Some effects are best described at the ecosystem level while others are best addressed at the species level. Some activities have only minor effects to plant and animal habitats. Activities that are not Federal actions, such as private oil and gas development, and the invasion of the hemlock woolly adelgid are addressed under cumulative effects.

Habitat indicator 1 –Structural class diversity

Effects Common to all Alternatives

Under all alternatives the remnant old growth habitat provided in Hearts Content Scenic Area and Tionesta Scenic and Research Natural Areas would not be actively managed. No commercial timber treatments would be scheduled in these areas. Tionesta Scenic and Research Natural Areas would continue to serve as areas for non-manipulative research, as baseline areas for measuring long-term ecological changes, and as control areas for comparing results from manipulative research conducted elsewhere.

Vegetation management

While all proposed activities have the potential to directly affect wildlife and/or indirectly alter habitat conditions, some impacts of vegetation management activities such as herbicide and prescribed burning are often misunderstood. Timber harvest also has the potential to alter wildlife habitat conditions and the following is a summary of direct and indirect effects of these treatments.

Table 3-49. Primary indicators and measures of plant and animal effects.

Primary Indicator	Habitat Assessed	Activities considered in the Analysis
Indicator 1. Amount and trends in Habitat Structure	Early, mid, and late structural habitat	Management Area allocations, vegetation management, reforestation practices, wildlife opening construction.
Indicator 2. Amount and trends in Habitat Composition	Oak, conifer, riparian/wetland, and aquatic habitats	Vegetation management and reforestation, management area allocations, road and trail construction, acid deposition, invasive species
Indicator 3. Changes in Habitat Patterns on the Landscape	Habitat connectivity, habitat patch size (core areas), remote habitat	Road construction. Trail construction and number and size of IUAs. Management Area allocations (wilderness study areas, remote recreation areas).
Indicator 4. Amount and trends in habitat for Management Indicator Species	<u>Northern goshawk</u> – mid to late structural, deciduous/conifer forest <u>Cerulean warbler</u> – mid-late structural oak forest with partially open canopy <u>Timber rattlesnake</u> – Remote and connected deciduous forest <u>Mourning warbler</u> – Early structural habitat <u>Aquatic Invertebrate Diversity and Relative Abundance</u> – stream water quality and physical habitat	Vegetation management, structural stages, recreation (including IUAs). Oak management, vegetation management and reforestation treatments. Vegetation management and reforestation treatments, road construction and trail construction (IUAs and EUAs), pit development. Vegetation management and reforestation, road and construction, herbicide application and prescribed burning Road construction and management, motorized trails (IUAs), vegetation management and reforestation, herbicide treatment.
Indicator 5. Amount and trends in habitat for Game Species	Early and late structural habitat, oak habitat, managed openings, old field/farm habitat	Vegetation management, oak management, motorized recreation (IUAs), winter range and brood rearing habitat, management area allocations
Indicator 6. Amount and trends of habitat for Species with Viability Concerns	Landscape and species level habitats and features, habitat structure and composition	Vegetation management, reforestation, road and trail construction and management, pit development, recreation activities, invasive species.

Timber harvest

The following is a discussion of anticipated changes in wildlife habitat conditions that are expected to result from timber harvest proposed under each of the alternatives. Although there are a variety of different timber harvest treatments, some treatments have similar effects on wildlife and wildlife habitat and have been grouped together to more clearly display anticipated effects. For the purpose of this analysis, harvest activities have been grouped into three categories including even-aged partial harvest, even-aged final harvest and uneven-aged management treatments. A detailed description of harvest activities and treatments are provided in the vegetation section of Chapter 3 and in Appendix A of the LRMP.

Even-aged partial timber harvest (thinning and shelterwood harvest)

Direct effects to wildlife from these types of treatments are generally short-term in nature and may involve some direct mortality of some species during logging, if cutting occurs during the breeding season. While cutting may result in avoidance of the site by some species sensitive to disturbance, because of the increase in browse and cover provided by increased levels of slash, other species are attracted to logging sites.

Although partial harvests maintain a mature overstory, they do alter stand structure and understory conditions by removing small to medium diameter trees and by increasing light levels to the forest floor. This results in an increase in the establishment of woody (trees and shrubs) and herbaceous (grass/forbs/fern) vegetation and is expected to improve wildlife forage and cover conditions on the site. While even-aged partial harvest treatments will result in some changes in stand structure, since mature forest conditions will continue to predominate following treatment, wildlife diversity on these sites is not expected to be significantly altered. This is supported by ANF monitoring of songbird, amphibian and small-mammals in areas receiving partial harvest activities (deCalesta 1998). However, the abundance of certain species will change, depending on the individual stand changes in the understory and mid-story that develops.

Even-aged final timber harvest (shelterwood removal, two-age harvest, and clearcutting)

As with partial harvest activities, effects may include some direct mortality if cutting occurs during the breeding season and some species that are sensitive to disturbance will avoid these areas. Since most of the mature overstory is removed, effects of these treatments on wildlife differ from those of partial harvest treatments. Also, while partial harvest treatments result in relatively minor changes in wildlife use, final harvest treatments can result in a much more dramatic change and some mature forest wildlife may be displaced for up to 50 years, or until a predominantly mature canopy is re-established. The reduction in overstory trees also results in a tremendous increase in herbaceous vegetation (grasses/forbs), shrubs (blackberry), and tree seedlings. This flush of understory vegetation provides habitat for early-successional species, as well as mature-forest species which utilize seedling/sapling habitat.

Due to increases in herbaceous, shrubby, and woody seedling vegetation, final harvest treatments are expected to favor early successional species over species that prefer or require mature forest

conditions. Although wildlife species diversity is not expected to decrease on sites receiving a final harvest treatment, there will be a short-term increase in the abundance of early successional species and a reduced abundance of some mature forest species on the site. This increase in early successional species is considered short-term in nature, because early successional habitat conditions decline within 10 years, and early successional species are replaced by wildlife that prefer the structural conditions provided by sapling/pole stands and some mature forest species (Thompson *et al.* 2001). Additionally, on the ANF, individual reserve trees and clumps of wildlife trees are retained during all regeneration harvest activities. As a result, the species present following regeneration harvest are expected to be similar to those that occupy the regeneration stage under natural succession (DeGraaf *et al.* 1992, DeCalesta 1998).

Uneven-aged timber harvest

Uneven-aged treatments include traditional uneven-aged management, as well as treatments that that will accelerate mature forest conditions (AMFC) and harvest that will restore understory conditions within existing mature forest (RUMFC). All of these treatments are designed to provide some of the structural conditions that characterize late successional forest, as well as restore understory diversity.

Uneven-aged treatments result in small patches of regenerating forest while maintaining a predominately mature canopy over most of the site. As a result, these treatments provide habitat primarily for mature forest species, including those species that use or require a small young forest component. Although these treatments will benefit a diversity of wildlife, due to the small size of the groups and patches of young forest created, this treatment would not be expected to provide habitat for early successional species that require larger openings, including some declining brush and shrubland species (DeGraaf and Yamasaki 2003). Like even-aged harvest, species sensitive to disturbance would likely move off the area during logging, although some direct mortality of wildlife could be expected to occur during implementation. While there are expected to be some changes in species abundance on the affected sites, uneven-aged treatments are not expected to reduce wildlife diversity.

Herbicide application

Toxicity

The wildlife and aquatic species risk assessment (Appendix G2) provides a detailed analysis of the hazards (toxicity) and exposure and assesses the potential risk from using sulfometuron methyl and glyphosate. Studies have shown high elimination rates and low tissue retention for both herbicides, indicating a very low risk of bioaccumulation. The results indicate that there are no substantial risks of acute or chronic adverse effects to any fish or wildlife species for typical and maximum exposures. Also, because proposed herbicides have been designed to target biochemical processes unique to plants, they exhibit a low level of direct toxicity to animals and when used according to label instructions, pose little risk to wildlife (Wildlife Society 2004). Finally, literature reviews on the direct acute effects of herbicides on wildlife have concluded that at recommended rates and normal use scenarios, herbicides used in forest management operations

pose little if any acute toxicity hazards to wildlife species, are not mutagenic or oncogenic and are rapidly eliminated from animal systems once ingested/absorbed (Tatum and Tatum 2004).

Habitat effects

Although herbicides generally are non-toxic to non-target organisms, they do affect wildlife communities by altering plant communities and successional trajectories, thus affecting plant community characteristics and animal communities via changes in habitat structure and composition (Guynn *et al.* 2004, Miller and Miller 2004). These effects can be both positive and negative. Also research on the effects of herbicides on small mammal habitats and the associated changes in species composition have also been reported with mixed results, which is believed to be largely due to the variety of habitats and treatment methods evaluated. In an effort to more accurately document effects of herbicide treatments and changes in wildlife habitat conditions specific to the ANF, the Understory Vegetation Management EIS (USDA FS 1991a) proposed pre- and post-treatment monitoring. This monitoring study was implemented in 1992 at ten Allegheny hardwood sites on the ANF. All sites received a shelterwood and herbicide treatment, with some sites being treated with herbicide prior to the shelterwood harvest and some sites receiving a herbicide treatment following cutting. In order to assess impacts on birds, small mammals and amphibian communities, pre-treatment, post herbicide and post herbicide/shelterwood data was collected between 1992 and 2002. The following summary of effects is based on the data collected during the study and preliminary analysis conducted to date (Scott Stoleson, *pers. comm.* 2004).

Mammal species richness, abundance and demography were evaluated. While effects varied by species, small mammal species richness initially declined after herbicide application, whereas herbicide treatment resulted in no detectable effect on the overall abundance of small mammals. Effects on abundance also varied by species, with no effect on mice as a whole, but a slight increase in *Peromyscus* mice, a short-term decrease followed by a recovery within 2 years for *Clethrionomys* voles and chipmunks and a decrease for shrews. Data also indicates that some responses reflect the behavior and habitat use of individual species, that there was no effect of herbicide application on the age ratios of chipmunks and *Peromyscus* (indicating no change in productivity), and that resulting changes observed were largely in response to changes in ground cover following treatment (Stoleson *pers. comm.* 2004).

Although there will be a slight tendency for sites treated with herbicides to support fewer bird species, there were no significant differences between treated and control sites in any single year. Differences among treatments were also minimal, and effects were no greater after the herbicide application or shelterwood cut, than before, which suggests that treatments had no discernable effect on the qualitative make-up of the avian community.

Following herbicide application, treated sites tended to have slightly reduced bird abundance compared to control sites, although the magnitude of those changes was far less than that of natural fluctuations resulting from an outbreak of elm spanworm. This reduction was not the same for all birds however and the relative impacts of herbicide treatment on avian abundance

varied among avian guilds, as well as among species within a single guild. The individual species responses reflect their dependency on those vegetative components affected by herbicide. Effects also varied by nesting guild, with no significant effect to ground nesters and cavity nesters, and a short-term decrease followed by recovery for canopy nesters. Populations of shrub-nesting birds did not recover by six years after herbicide application, probably due to the inhibition of regeneration by white-tailed deer. Following the establishment of deer fences in 2000, woody regeneration, and shrub birds, responded rapidly such that by 2004 there were no longer any differences between treatments in abundance of shrub birds, or any other measure of avian community. Overall, avian species richness, diversity and dominance were not affected by treatment, whereas avian abundance showed a decrease, which did not rebound until deer fencing allowed the regeneration of the understory.

Terrestrial amphibians were sampled using board complexes and pitfall traps. Preliminary data shows that almost all animals recorded were red-backed salamanders (*Plethodon cinereus*) and numbers found under board complexes were negatively correlated with soil temperature and declined significantly following shelterwood cutting presumably because loss of canopy cover increased solar radiation. Although the decline was most pronounced on subplots treated with herbicide prior to shelterwood cutting, the ANF found no independent effect of herbicide application on salamander numbers. The decline due to shelterwood treatment was rather short lived and numbers had rebounded two years after cutting. No other effects of either shelterwood or herbicide treatment on salamanders were found.

In conclusion, effects of herbicide application on wildlife are determined largely by the dependence of the individual species on the woody and herbaceous vegetation affected by treatment. Many of these effects are short-term in nature and considering most sites proposed for herbicide application will be followed by a removal cut within 5-10 years, long-term effects on wildlife will be determined largely by the dramatic changes in overstory vegetation following the final harvest treatment (described previously).

Prescribed burning

Some prescribed burning is proposed under all alternatives in order to meet management objectives related to establishment of oak seedlings. Proposed burning is expected to have some direct effects on wildlife inhabiting the site at the time of treatment. Behavioral avoidance of wildlife by fire is documented in Landers (1987) and it has been observed that less mobile species such as small rodents are most likely to panic, while larger mammals usually move calmly during the fire. Upland game birds, raptors and many smaller birds are often attracted to fire or to the smoking landscape as foraging sites. Prescribed burning in the southeast indicates that deaths of wild animals are seldom attributed to fire (Landers 1987). Although Means and Campbell (1981) noted deaths of several reptiles, they went on to say that very few reptiles and amphibians are killed by prescribed fire. Similarly, review papers edited by Wood (1981), listed no fire induced mortality of tree squirrels, furbearers or black bears. The ability of small mammals to go underground or to emigrate apparently accounts for the scant evidence of mortality from heat or suffocating smoke (Taylor 1981). Indications are that fast moving burns in habitats of less mobile

species would likely be involved when death results. When mortality does occur, it is usually negligible at the population level (Lyon *et al.* 1978).

Most undesirable direct effects are overcome by choosing proper times, places and methods of prescribed burning. Since proposed burning will consist of a relatively slow moving strip headfire or backing fire and will be done on a small scale, direct mortality resulting from proposed burning is not expected to be significant.

Indirect effects of proposed burning include modifications or changes in conditions on the affected sites. In the short term, effects on vegetation from burning include maintaining relatively open understory conditions followed by development of herbaceous and woody vegetation. While vertical stand structure may be temporally reduced on controlled burn sites, overall plant species diversity is expected to increase on the site, as well as create more complex understory conditions than existed prior to the burn. This is supported by on-forest monitoring, in which a comparison of species richness shows a dramatic three-fold increase in the total number of species present in the treated stand over the adjacent unmanaged stand (Hays unpublished 2001). Additionally, due to excessive browsing by deer, many of these species are not commonly found on the ANF and the three-fold increase is believed to be due to a combination of fencing, opening up of the overstory and burning.

Effects of burning on the bird community can vary over time and burning usually does not affect bird communities through habitat changes for several years (White *et al.* 1999). Bendell (1974) summarized a number of studies that evaluated the effects of burning on birds and concluded that overall, the number of species of birds increased after burning. The number of species that fed on or near the ground increased the most, as might be expected with the increase in grasses, herbs and shrubs following burning. Dormant season (April 15 through May 1) burns produce low-growing, sprouting regeneration of shrubs and trees and stimulate the production of soft mast (Stansky and Rose 1984). These responses would provide forage, cover and arthropod prey for many songbird species (Dickson 1981).

Proposed burning is expected to result in mortality of some overstory trees. However the creation of dead and dying trees provide important foraging sites for woodpeckers and other bark gleaning species such as the black and white warbler. Snags also provide perching/hawking sites and roosting/nesting habitat.

The increase in soft mast from rejuvenated shrubs, as well as the increased vegetative structure and diversity that occurs on the site following burning, is expected to increase the diversity and abundance of wildlife species utilizing the stand. Additionally, since oak is a fire tolerant species and has developed on the ANF as a result historic burning by Native Americans, proposed burning is expected to restore fire adapted ecosystems and help sustain the oak type over the long term.

Effects by alternatives

Early structural habitat

Vegetation management activities and time are the primary means through which vegetative structural conditions will change on the ANF in the first and second decades of LRMP implementation. The average annual amount of each major vegetation treatment is provided in Table 2-2. Structural conditions anticipated by 2020 by alternative are displayed in Table 3-50. Alternatives A and B would result in the largest acreage of early structural conditions (9 percent of FS lands), whereas Alternative D would result in the lowest acreage of early structural conditions (4% of FS lands). In the long term (2060) Alternatives A through D would result in 14, 12, 10, and 3 percent early structural conditions, respectively. These structural classes are based on the average diameter of dominant canopy trees as shown. Uneven-aged management maintains stands in the mid to late structural stages where it is applied.

Late structural habitat

By 2060 the amount of late structural forest would vary from 24 percent of National Forest land in Alternative A to 39 percent in Alternative D (Table 3-50). Over the long term, Alternative A provides a more even distribution of structural classes with 14 percent early structural forest, 48 percent mid structural forest, and 24 percent in late structural forest. Alternative B provides the second most even distribution of structural classes with a mix of 12, 49, and 25 percent early, mid, and late structural conditions, respectively.

About 5,800 acres consisting of unconnected areas were identified to provide future old growth forest habitat (late structural forest) in site specific project analyses under the 1986 Forest Plan. Some of these areas may not have old growth characteristics at this time, some may have experienced intensive oil and gas development that diminished their old growth characteristics, and none of them are over 300 years old. Under Alternative B, 3,869 acres previously identified as old growth habitat would continue to be managed to provide old growth characteristics. These previously identified areas would be re-evaluated in future site-specific analyses to determine the appropriate management emphasis. In Alternatives B, Cm, and D, areas with old growth characteristics are primarily provided in portions of MAs 2.1, 2.2, 6.1, 7.2, 7.3, 8.1, 8.2, 8.3, and 8.5. Part of the rationale for MA 2.2 in Alternatives B, Cm, and D is to avoid an approach that provides small, scattered parcels of old forests and instead provides large patches of old growth that are more connected across the landscape.

Landscape changes

The landscape codes described previously, which break the Forest down by predominate landscape condition and management were used to compare the relative landscape conditions under each of the alternatives, which are displayed in Table 3-51.

Table 3-50. Current and estimated future (2020 and 2060) structural stage conditions for National Forest System lands by alternative.

	Current	A		B		Cm		D	
		2020	2060	2020	2060	2020	2060	2020	2060
Early-structural (canopy trees 0-5")	7%	9%	14%	9%	12%	8%	10%	4%	3%
Mid-structural (canopy trees 6-20")	77%	72%	48%	71%	49%	72%	48%	75%	51%
Late-structural (canopy trees >21")	4%	8%	24%	10%	25%	10%	28%	9%	39%

Note: Numbers will not add up to 100%—remainder is either non-forested or developed lands. Data derived from SPECTRUM model

Table 3-51. Alternative Landscape Conditions

Landscape Code	Alt. A		Alt. B		Alt Cm		Alt. D	
	Acres	%*	Acres	%*	Acres	%*	Acres	%*
1	33,707	6.7	140,874	27.8	175,986	34.7	207,722	41.0
2	130,521	25.8	11,922	2.4	19,258	3.8	154,123	30.4
3	332,818	65.7	335,425	66.2	292,615	57.8	127,771	25.2
4	7,955	1.6	7,575	1.5	7,937	1.6	6,215	1.2
5	1,473	0.3	10,678	2.1	10,678	2.1	10,643	2.1
Total	506,474		506,474		506,474		506,474	

*percent of total National Forest System lands

The biggest difference between alternatives is in the amount of predominately late structural habitat (Landscape Codes 1 and 2) that will be provided in the future and in the amount of forest that contains a diversity of forested age classes and structures (Landscape Code 3). Due to the increased amount of MA 2.2 lands and lands devoted to uneven-aged management, Alternative D will result in the greatest amount of late structural habitat and under this alternative, over 70 percent of the Forest will have a landscape condition where late structural conditions predominate. Whereas the amount of forest that contains a greater diversity of forested age classes will be reduced by approximately 40 percent under Alternative D and Landscape Code 3 will be reduced to approximately 25 percent of the ANF.

There will be little change in landscape condition under Alternatives A and B, both of which will continue to provide approximately 30 percent of the Forest in a predominately late structural condition (Codes 1 and 2) and approximately 65 percent of the Forest in a landscape that contains a greater diversity of age classes (Code 3). Under Alternative Cm, the amount of late successional forest across the landscape will increase slightly (6%), whereas more diverse landscape conditions (Code 3) will decrease by almost 8 percent.

Permanent openings

Two percent of the ANF will be managed as permanent openings for wildlife under all alternatives. Most permanent wildlife openings are less than 5 acres in size and occur in a variety

of ecological land types. Existing permanent openings would continue to be managed in all management areas except MA 5.1, 5.2, 7.2, 8.3, and 8.5. New permanent wildlife openings would be permitted in all management areas except MA 5.1, 5.2, 2.2, 7.1, 7.2, 8.2, 8.3, and 8.5 under all alternatives. Openings would benefit species such as ruffed grouse, wild turkeys and woodcock.

In summary, Alternatives A, B, and Cm provide increased levels of early and late structural habitat, both in the short and long term. Alternative D will result in a short- and long-term reduction in early structural habitat and the largest increase in late structural habitat. Early structural species such as the American woodcock, ruffed grouse, beaver, and white-tailed deer would benefit the most under Alternative A and mid to late structural species such as the barred owl, black-throated green warbler, great blue heron, hermit thrush, pileated woodpecker, red-shouldered hawk, and yellow-bellied sapsucker would benefit most under Alternative D.

Over the long term, Alternatives A and B, and to a lesser extent Alternative Cm, would encourage more horizontal structure. Even-aged regeneration activities would create early structural vegetation that would otherwise be declining, except for what might be created on private lands or through larger scale natural disturbances. Alternative D would result in the greatest amount of late structural vegetation after 5 decades of LRMP implementation.

Habitat indicator 2 – Amount and Trends in habitat composition

Effects common to all alternatives

The ANF recognizes the value of sustaining a diverse composition of habitats for sustaining a diversity of plant and animal species. Under all alternatives wetland and riparian habitats will be buffered (see water resources section). Management actions will emphasize retaining, enhancing, and restoring of riparian and wetland values. Aquatic habitats (rivers, streams, and impoundments) will be managed to maintain the water quality important to many species of fish, mussels, insects and others. Both the oak and conifer components will be maintained across the landscape. All alternatives will utilize prescribed burning and even-aged management to restore oak communities and enhance mast production over the long term. The amount of conifer and the effects to conifer habitat will not change by alternative.

Effects by alternative

Oak forests

Since oak forests are valuable to many plant and animal species, research has focused on ways to regenerate healthy oak stands and enhance acorn production to ensure that oaks remain a viable habitat component in Eastern Forests (McShea and Healy 2002). Even-aged management and prescribed burning are two treatments that promote the regeneration of healthy oak forests (Brose and Van Lear 2004, Loftis 2004). These treatments are permitted in MAs 1.0, 2.2, 3.0, 6.1, 6.2, 8.6, and 9.1. As a result, under Alternatives A, B, Cm, and D, 77 percent, 53 percent, 49 percent, and 33 percent respectively of the ANF oak acreage are allocated to MAs where scheduled regeneration treatments could occur (Table 3-52).

Table 3-52. Percent of oak managed by primary silvicultural system under each alternative.

Percent of oak type managed by primary silvicultural system*	Alt A	Alt B	Alt Cm	Alt D
Even-aged	77%	53%	49%	33%
Uneven-aged	0%	0%	0%	4%
No Active Management	23%	47%	51%	63%

*Estimated percent of total amount of current oak type allocated to be managed by primary silvicultural system. This is determined by MA from a base of 75,000 acres. (Even-aged in MAs 1.0, 2.2, 3.0, 6.1, and 6.2; Uneven-aged in MAs 2.1; No active in MAs 5.x, all 7.x, all 8.x, and 9.1). Note: Oak is usually managed with even-aged silviculture in MA 2.2 and is shown that way here).

Table 3-53. Estimate of current oak types by structural stage at 2020 and 2060 by alternative.

		Year 2020				Year 2060			
Structure/Alternative	Current	A	B	Cm	D	A	B	Cm	D
Early structural (ac.)	1200	250	200	700	700	4100	6300	5500	1200
Mid structural (ac.)	61,000	41,000	32,900	33,300	34,200	2300	3100	4400	1800
Late structural (ac.)	13,000	33,000	41,500	41,800	40,200	54,700	51,800	53,400	58,200

(Acres from SPECTRUM model)

Oaks in management areas where these treatments were not employed would continue to grow large, some developing large cavities and some dying and eventually falling over. Uneven age management that utilizes 3-acre group selection openings (RUMFC prescription) would likely be effective for regenerating oaks and remains an option in MA 2.1, 2.2, and 6.1. Although these large oaks would provide dens and cavities for a variety of wildlife, some tradeoff is expected in both acorn production and the likelihood that oaks will remain a component of the stand in the future (Gribko *et al.* 2002, McShea and Healy 2002). By 2060, the oak type would not change by more than 2 percent under any alternative.

Structural stages of oak on the ANF at the end of the planning period and at year 2060 are provided by alternative in Table 3-53. During the planning period not much change occurs in the structural stages of oak but over the long term Alternative B provides slightly more even distribution of oak across structural stages than the other alternatives. However, across all alternatives late-structural oak will comprise between 84 and 94 percent of the oak by 2060.

Wetland habitats

In Alternative A, the 1986 LRMP would provide very minimal direction for the protection of amphibian habitat around wetlands and vernal pools. In the other alternatives, standards and guidelines for wetland management zones (2500 Watershed and Air section in the LRMP) provide better direction for the protection of critical amphibian habitat. Within this habitat, it is important to maintain forest floors with suitable conditions, such as minimal compaction and rutting, deep litter, coarse woody debris, and canopy shade (Calhoun and Maynadier 2004).

Rivers, streams, and impoundments

The Water Resource Environmental Consequences provides a thorough discussion on the effects of various management activities to water resources, which can affect fish and other aquatic species and their habitats. The reader should review this section as well. Some of the following discussion is similar.

Aquatic habitat management

Treatment of stream habitats would occur in all alternatives (Table 2-2). Specifically, Alternatives B, Cm, and D provide an objective for the restoration or improvement of an average of 2 miles of instream habitat conditions per year. Alternative A does not provide an objective, but does allow this type of work to occur. Efforts would be focused on improving the amount and quality of cover and pool habitat that is lacking in many streams on the ANF, but would also provide important hydrological benefits as well. For example, large wood in headwater streams traps sediment which would benefit species downstream, such as mussels, in the larger streams and rivers. Large wood within the stream channel would also provide cover and refuge areas for a variety of stream fish and aquatic invertebrates, including many of the RFSS aquatic invertebrates (such as the dragonflies). Pools are important features for holding larger, mature fish and as refuge areas during high flows.

Efforts to provide improved habitat conditions in impoundments would occur in Alternatives B, Cm, and D on an average of 32 acres per year. The improvements would provide cover and spawning areas for a variety of game and non-game fish. Numerous fish habitat improvement structures placed in the Allegheny Reservoir in the past have been monitored and have shown a higher percentage of fish usage when compared to areas where there is no structure. Fish habitat work in Alternative A is currently dependant on individual project analysis, and would continue under this direction. Thus, all alternatives would provide improved habitat conditions in impoundments.

Vegetation management

The harvesting of trees along streams has the potential to affect stream shading through the removal of potential large wood recruitment, and the introduction of sediment to intermittent and perennial stream channels. These potential outcomes could indirectly impact fish and other aquatic species that inhabit not only streams in the immediate area of the activity, but downstream as well. The loss of shading can lead to increases in stream temperature and potential loss of leaf litter input until trees become large again. However, small, scattered openings along streams generally will not negatively affect stream water temperature and in some cases can increase productivity. Vegetation management in riparian areas may increase the potential for sustaining trees on the site.

The removal of larger trees along streams can result in the loss of potential large wood to fall into streams and create a greater diversity of aquatic habitat. Large wood provides aquatic species with cover and creates pools and slow-water areas. Hydrological functions provided by large wood in a stream and important to aquatic habitat could potentially be affected as well.

The use of herbicides to treat understory vegetation for reforestation purposes as well as for treating non-native invasive plants, for wildlife habitat, and for meeting visual objectives would occur in Alternatives B, Cm, and D. The use of herbicide would also still occur under Alternative A, but with a different set of standards and guidelines. The Wildlife and Aquatic Species Risk Assessment (Appendix G2, pp. G2-5 to G2-10) shows that there is no significant risk to wildlife or aquatic species exposed to either glyphosate or sulfometuron methyl when properly applied.

The potential for the above vegetation effects to occur is similar for Alternatives A and B, and slightly less in Alternative Cm. Alternative D provides a much lower harvest rate and herbicide application and thus the potential for effects to occur are the least. However, in all alternatives, several LRMP standards and guidelines related to protecting aquatic resources would be implemented that would protect aquatic species and their habitat. This includes such things as providing filter strips to protect streams from sedimentation, providing buffer strips along streams and other waters to protect aquatic resources from herbicides, and providing for adequate shade to prevent excess water temperatures in streams. To provide for the long-term maintenance and natural recruitment of large wood to streams, riparian vegetation would be managed using uneven-aged management and would occur on three percent of the riparian acreage per decade in MAs suitable for vegetation management.

Road construction and management

Forest roads located within 300' of a stream have the highest potential for contributing runoff. These dirt and gravel roads can be a potential long-term source of sediment that can fill pools and embed gravels, habitats that are important to various life history stages of fish and aquatic invertebrates in headwater streams and mussels in the larger waterways, including the Allegheny River. New roads proposed for construction within 300 feet of a stream is highest in Alternative A and lowest in Alternative D (Table 3-10, 2500 Water Resource section). Implementation of standards and guidelines and site-specific mitigation measures would minimize the amount of runoff reaching a stream. Likewise, the conversion of non-system roads to Forest Service roads within 300 feet of streams is similar in Alternatives A-Cm, but slightly less in Alternative D. While these roads will also continue to be a potential long-term source of sediment to streams, the amount would be reduced because of a higher quality of surfacing material that would be used than currently exists on these roads.

As part of the road proposals, some existing dirt and gravel roads within 300' of a stream would be decommissioned. A beneficial effect to aquatic habitat would result due to the elimination of a potential long-term source of sediment, primarily in Alternative D, where 2.2 miles would be decommissioned. Alternatives A and B propose only 0.1 miles each, and Alternative D is 0.5 miles.

Motorized ATV/OHM Trails

Several areas of the ANF are proposed for Intensive Use Areas (IUAs) where motorized ATV/OHM trails can be constructed. The effects described for road construction and management are similar for these types of trails.

During the implementation of the current 1986 Forest Plan, a better understanding of the effects of trails on streams was developed between various resource specialists that have led to the improvement of many miles of trails. These adaptive improvements identified after trail monitoring include such things as using a harder stone surfacing in more sensitive areas, re-routing sections of trails, conducting maintenance more frequently, among others. This has led to a further reduction of fine sediment.

Assuming the effects are proportional to the number of acres available for development of trails, Alternative B has a much higher potential for effects to occur. This is followed by Alternative A, Alternative Cm, and Alternative D. Using this rationale, Alternative D would pose the lowest potential risk to aquatic species and their habitat.

Wilderness study areas

Additional areas on the ANF are proposed in Alternatives Cm and D for inclusion into Federal Wilderness Study Areas (Table 2-1). The proposed areas include several miles of cold-water streams providing suitable habitat for trout and other headwater aquatic species.

Alternative D would provide the greatest mileage of streams and aquatic habitat into Wilderness Areas. Aquatic resources would be protected from potential land-disturbing activities such as dirt and gravel roads and off-highway vehicle trail construction and maintenance. The beneficial effects would be greatest for the Minister Creek Valley and Chestnut Ridge because these are currently in management areas where land-disturbing activities can occur. Tracy Ridge and Allegheny Front are currently in National Recreation Areas where currently no land-disturbing activities are occurring.

Alternative Cm, while only providing for two Wilderness Study Areas, include Minister Creek and Chestnut Ridge. The number of miles of streams would be less than Alternative D, but as described above, these two areas would move from management areas with potential land-disturbing activities to a more protected status.

See Game Fish section for more effects discussion from the proposed Wilderness Study areas.

Herbicides

Because herbicide treatment is complex and sometimes controversial and can affect both habitat structure and habitat composition, it is addressed separately here. All alternatives allow both sulfometuron methyl and glyphosate to be used to reduce vegetation that interferes with the establishment of tree seedlings (primarily ferns, grasses, striped maple and beech suckers), and to enhance wildlife habitat where vegetation interferes with the establishment of planted shrubs and trees (e.g. viburnums and apple trees). Alternatives B through D allow these two herbicides to also be used to control non-native invasive species (e.g. garlic mustard or Japanese knotweed) and to achieve heritage resource and visual management objectives.

Herbicide spraying affects animals by causing short-term and long-term habitat alterations. Physical disturbance may occur when animals are present when herbicides are applied. For this discussion short term habitat alterations are the immediate effect of the herbicide on the vegetation and last less than 3 years. Long term habitat alterations are described as the effect herbicide treatment has on the vegetation three years after application and beyond.

The Wildlife and Aquatic Species Risk Assessment (Appendix G2) provides a detailed analysis of the hazards (toxicity) and exposure and assesses the potential risk from using sulfometuron methyl and glyphosate. Studies have shown high elimination rates and low tissue retention for both herbicides, indicating a very low risk of bioaccumulation. The results indicate that there are no substantial risks of acute or chronic adverse effects to any aquatic or wildlife species for typical and maximum exposures.

Water quality monitoring of silvicultural treatments have shown that buffer zones are adequate for protecting stream water quality (USDA FS 1988 p.18-19, 1989 p.15-17, 1990 p.22-24, 2002 p.50-51) using the buffer guidelines in the 1986 Forest Plan. Specifically, water samples collected and analyzed for the specific active ingredients (glyphosate and sulfometuron methyl) were within water quality protection criteria and thus any effects were prevented from occurring.

Alternatives B, Cm, and D provide new guidelines for herbicide application when working near water (Appendix G2, pp. G2-10 and G2-11). The buffers would be narrower depending on the method of application (e.g. individual stem) and the herbicide that is used, but the risk assessment indicates that these buffers are adequate for protecting aquatic species. Additionally, surfactants used in the application are approved for aquatic use should any accidentally enter water where aquatic species occur.

Herbicides impact the habitat by altering the understory structure and composition. Research on the ANF has shown that understory alterations cause a decrease in the number of shrews and an increase in the number of mice (Stoleson *pers. comm.* 2005). Shrub nesting birds also showed a decrease in abundance. All impacts were short-lived as the site became re-vegetated (Stoleson *pers. comm.*, 2005).

Although the acreage treated with herbicide varies by alternative, none of the alternatives are expected to have a substantial impact to aquatic and wildlife species. Impacts to shrews and shrub nesting would be minor and short term under all alternatives.

Habitat indicator 3 – Changes in habitat patterns on the landscape

Effects common to all alternatives

Under all alternatives the Allegheny Front, Cornplanter, Hickory Creek Wilderness, and Tracy Ridge would remain in management areas where Forest Service roads would be prohibited or greatly restricted. The result would be about 21,000 acres (>1/4 mile from a road) of high quality remote habitat under all alternatives.

Silviculture treatments within the late structural linkages would be focused on restoring late structural forests and enhancing habitats for certain species with viability concerns. Specific uneven-aged treatments that restore forest structure and promote understory development would occur in Northern, Upland, and Allegheny hardwood stands. Even-aged management would be practiced in oak dominated habitats to restore understories, enhance mast production, and regenerate oak forests. The resulting conditions would include the enhancement of many older forest characteristics such as big trees; multiple layered canopies; canopy gaps; diverse forbs, shrub, and seedling understories; and large dead wood both standing and down.

Effects of alternatives

Remote habitats

Adverse effects to existing remote habitats will be measured by the level of new road and motorized trail construction in unroaded areas which increase human access and increase noise levels resulting in disturbance to some wildlife species.

Of the 37 areas without roads greater than 500 acres identified in the Forestwide Roads Analysis (USDA FS 2003b), 29 are considered quality remote wildlife habitat and 8 are considered high quality remote wildlife habitat. The percent of the 29 quality remote habitats (28,200 acres) and 8 high quality remote habitats (33,000 acres) that will remain in management areas where Forest Service roads and motorized trails are prohibited or greatly restricted (MAs 2.2, 6.3, 7.2, 7.3, 8.1, 8.2, 8.3, and 8.5) is provided by alternative in Table 3-54. This does not mean that all areas without roads in management areas that allow new road construction will be roaded.

Under Alternative A, the Morrison Run area would remain in MA 6.2 where intensive timber harvest would occur on about 2,070 acres for 10 years followed by no timber activity for 30 years. An additional 1,200 acres of high quality remote habitat would remain in MA 3.0 subject to new road and timber harvest reducing its value as remote habitat. Under Alternative B, Chestnut Ridge would become an IUA for off-highway vehicles diminishing its value as high quality remote habitat. Currently Chestnut Ridge is not within a known oil and gas field, so if it is not designated as an IUA it is likely to retain a large amount of its remote habitat character. In addition to Chestnut Ridge, about 8,100 acres (29%) of quality remote habitat would become intensive use areas where new motorized trails would be constructed.

Under Alternatives Cm, 88 percent of the highest quality remote habitat and 60 percent of the quality remote habitat (respectively) would remain in management areas that contain direction compatible with sustaining these remote habitats. Impacts could occur from future private mineral development and are addressed under cumulative effects.

Table 3-54. Percent of the highest quality remote habitat that will remain relatively free of new Forest Service roads and motorized trails by alternative* (The present condition is the same as Alternative A).

	Alt. A	Alt. B	Alt. Cm	Alt. D
Percent of High Quality Remote Habitat that will remain in management areas that substantially restrict new road/motorized trail construction (8 areas, 33,000 acres)	63	81	88	88
Percent of quality remote habitat that will remain in management areas that substantially restrict new road/motorized trail construction (29 areas, 28,200 acres)	35	38	60	60

*Roading by private mineral development could occur on all areas (except where USA minerals have been withdrawn from development). Oil and gas development expanded into a portion of the Morrison Run area during the summer of 2006.

Core areas and habitat connectivity

Under Alternative A, landscape connectivity of late structural forests would primarily be provided by Management Area 6.1 where the forest would “generally progress to a mature hardwood type.” Connectivity was not a focus of the 1986 Forest Plan and the arrangement of MA 6.1 would not provide any north-south connection between Clarion core area and core areas to the north. Tionesta Scenic and Research Natural Areas would not form an east-west connection with Hickory Creek Wilderness and Allegheny Front. Designation of late structural habitat in MA 3.0 would primarily remain as small scattered parcels. The forest matrix as a whole would become less connected and more fragmented as 120 miles of new Forest Service roads, and the potential capability of 73 miles of new motorized trails could be constructed during the planning period. Private oil and gas roads are covered under cumulative effects. As the forest matrix becomes less contiguous and more roaded, movement of some species between core areas becomes more difficult resulting in less genetic interchange and loss of resiliency (Lindenmayer and Franklin 2002, Morrison *et al.* 1992). More roads would result in some species with viability concerns becoming more limited in their distribution across the landscape (e.g. timber rattlesnakes, wood turtles, northern flying squirrels, etc.). The acreage that would be managed with an emphasis on connectivity and an emphasis on core areas is provided in Table 3-55.

Under Alternative B, core areas are connected with a relatively continuous high canopy and designated as MA 2.2. The Clarion River unroaded area becomes a remote recreation area with contiguous high forest canopy. Throughout the forest matrix about 105 miles of new road would be constructed, and the potential capability for 124 miles of new motorized trail could be built. In essence, MA 2.2 in Alternative B rearranges most of MA 6.1 from Alternative A to link the core areas. About a third of the known rattlesnake dens on the ANF would occur in MA 2.2 where the emphasis is on connectivity, while 18 percent of known goshawk nests would occur in core areas. By spatially arranging late structural habitat so that core areas are connected, genetic heterozygosity will likely be maintained and species resiliency enhanced in the core areas.

The Longhouse IUA could potentially impact connectivity under Alternative B. Potential impacts to a Class A trout stream, to concentrations of nesting raptors, and to turkey winter range and brood rearing habitat are some of the important habitats that would need careful consideration in trail design in this IUA.

Table 3-55. Acres managed with an emphasis on habitat connectivity and an emphasis on core areas. (Percentages are percent of total National Forest lands, The present condition is the same as Alternative A)

Emphasis	Alt A	Alt B	Alt Cm	Alt D
Acres Managed for Connectivity (MA 2.2)	0* 0%	99,000 19%	121,000 23%	129,000 25%
Acres Managed as Core Areas (MA 5.1, 5.2, 7.2, 7.3, 8.2, 8.3, 8.5,)	34,000 7%	41,000 8%	55,000 11%	79,000 15%

*Although connectivity was not a specified objective of MA 6.1, it none-the-less provided some late structural landscape level connectivity.

New remote recreation areas (M.A. 7.2) under Alternatives B through D would become new core areas as existing roads are decommissioned. Silviculture treatments in the new core areas (MA 7.2) would be limited to management activities that address recreation and scenery objectives, user safety, wildlife concerns, forest health, or catastrophic events such as wind or ice storms. These types of treatments for the core areas would be the same under Alternatives B, Cm, and D. However, the amount of each treatment would change as the Management Area acreages change by alternative.

Under Alternative Cm, Chestnut Ridge becomes a proposed wilderness study area. The result would be the creation of two large core areas separated by State Route 321. About 75 miles of new Forest Service road would be constructed and the potential capability for 45 miles of new motorized trails could be developed throughout the forest matrix during the planning period. Both the acreage of connected late-structural habitat and core areas are substantially increased under Alternative Cm from that in Alternative B (Table 3-55), providing well distributed and connected habitat. In the event of large catastrophic weather events or large scale intensive mineral development, this alternative provides less risk than Alternative B that late structural habitat connectivity would be substantially compromised. Species re-colonization and resiliency of core areas would be expected to increase over Alternative B. Fifty five percent of known rattlesnake dens would occur in MA 2.2 and 32 percent of the known goshawk nests would occur in the core areas under this alternative.

Alternative D widens the late structural linkages, increases the number of connections, and includes seven remote recreation areas (MA 7.2) as core areas. Under this alternative, about 40 percent of the ANF would be managed as late structural forest using core areas connected with high canopy forests (the most of any alternative). Habitat connectivity is enhanced with a reduction in the size of the existing Duhring-Allegheny IUA and no development of new IUAs. About 70 miles of new Forest Service roads would be constructed and the potential capability for 12 miles of new motorized trails could be built throughout the forest matrix during the planning period. Fifty-five percent of the known rattlesnake dens would occur in MA 2.2 and 33 percent of the known goshawk nests would occur in the core areas under this alternative. Several miles of existing trails would be eliminated.

Alternative A provides landscape patterns that would benefit species that utilize early structural habitat and edges such as American woodcock, ruffed grouse, beaver, and white-tailed deer. Alternative D provides mid-late structural landscape patterns that would benefit the barred owl, black-throated green warbler, great blue heron, hermit thrush, pileated woodpecker, red-shouldered hawk, timber rattlesnake, and yellow-bellied sapsucker.

Alternatives B and Cm provide mixes of landscape patterns between Alternatives A and D. Alternatives B and Cm provide core areas and linkages of late structural habitat while increasing the amount of early structural habitat from the present condition.

Habitat indicator 4 – Amount and trends in habitat for management indicator species

Effects to the five management indicator species are described in this section.

Northern goshawk

Direct and indirect effects

Direct and indirect effects will be evaluated by looking at management area allocations, standards and guidelines and management activities that may cause direct mortality or harassment to individuals, as well as activities that may alter habitat conditions at either the site or landscape scale. Both short- and long-term effects will be evaluated and for the purpose of this analysis, short term effects will be looked at by evaluating habitat conditions in the year 2020, whereas 2060 will be used as the point in time when potential long-term effects are evaluated. A more detailed discussion of habitat and effects is discussed in the Biological Evaluation since this species is also a RFSS.

Effects common to all alternatives

Direct effects to the goshawk could result from any activity that causes harm or harassment to nesting birds. Any activity that occurs within active goshawk territories, or any activity that creates unsuitable goshawk habitat, could have adverse direct and indirect effects. In order to reduce harm and harassment to nesting birds, all alternatives include design criteria to provide some level of nest protection that will reduce harm or harassment to nesting birds and maintain suitable habitat conditions around the nest site. With implementation of these design criteria, adverse effects to nesting birds will be greatly reduced.

Because the number of active nests on the Forest has declined in the last two years and in an effort to reduce potential cumulative effects in the face of increasing oil and gas development, Alternatives B, Cm, and D raise the level of protection to active goshawk nests by doubling the area around the nest site that is protected. In addition, Alternatives B, Cm, and D include design criteria that will ensure that 1) suitable habitat is maintained for alternate nest sites, 2) desired habitat conditions are maintained within active territories, and 3) nest protection design criteria stay in place for up to five years following the last year of documented occurrence. So while all alternatives will reduce the potential impact to nesting birds, a greater level of protection is provided under Alternatives B, Cm, and D.

Because of the northern goshawks sensitivity to disturbance, new road construction as well as management of existing roads has the potential to adversely affect this species, although the actual disturbance varies with both the type of road and intensity of use. On the ANF, goshawks successfully nest in areas with low-standard roads and prefer areas where existing roads receive little daily use. While the amount of new road construction varies by alternative, all alternatives require that roads within active territories be closed to public use and as a result, potential impacts from any new road construction will be reduced to a level that Forest monitoring indicates is consistent with goshawk use.

Approximately 79 percent of the ANF presently provides the structural conditions preferred by the northern goshawk for nesting, and although the amount of suitable nesting habitat varies somewhat by alternative (described below), all alternatives will ensure that suitable nest habitat is maintained across the landscape. Similarly, although the amount and quality of foraging/post fledgling habitat varies somewhat by alternative, all alternatives will continue to maintain a predominance of suitable conditions across the landscape and ensure that forest-wide viability for this species is maintained.

Effects by alternative

While all alternatives maintain viable goshawk populations and provide adequate habitat to support desired nesting densities, they each vary in terms of the quality and quantity of habitat that will be provided at the landscape scale. Table 3-56 displays the landscape conditions that will characterize currently active territories under each of the alternatives.

Although the goshawk prefers mature forest for the nest site, on the ANF it selects landscapes that are relatively diverse, as is indicated by the large amount of occupied habitat that presently occurs within landscape code 3. This is consistent with research that indicates that goshawk prey species need a variety of habitat conditions from early to mature seral stages (Kimmel and Yahner 1994). Landscape conditions within active territories under Alternatives A and B will remain relatively unchanged in the future. There will be a slight increase in late structural landscape conditions under Alternative Cm (Codes 1 and 2) and a large increase in predominately late structural conditions within active territories under Alternative D. Although landscape conditions preferred by the northern goshawk vary somewhat by alternative, all alternatives will provide landscape level nesting and foraging habitat conditions that Forest monitoring indicates is consistent with goshawk use.

While goshawk territories on the ANF contain diverse habitat conditions, they prefer predominantly mature forest conditions for nesting and Table 3-57 displays the amount of suitable nest habitat that will occur under each of the alternatives both in the short and long term.

Table 3-56. Alternative landscape conditions of active goshawk territories (percent of ANF)

Landscape Code	Present Condition	Alternative A	Alternative B	Alternative Cm	Alternative D
1	0.2	0.2	7.2	22.3	31.8
2	17.8	17.8	0.4	0.3	34.8
3	82	82	92.4	77.4	33.4

Table 3-57. Suitable goshawk nest habitat by alternative (percent of ANF)

	2006	2020				2060			
		Alt A	Alt B	Alt Cm	Alt. D	Alt A	Alt B	Alt Cm	Alt. D
Suitable Nest Habitat ¹	79	76	76	77	80	71	72	73	83

¹ Suitable goshawk nesting habitat = forests >30 yrs. old.

By 2020, suitable goshawk habitat will decline by 2-3% under Alternatives A, B and Cm and there will be a slight increase in habitat under Alternative D. However, due to the amount of even-aged regeneration harvest proposed over the long-term (2060), suitable goshawk nest habitat will be reduced by 15 percent, 14 percent and 10 percent under Alternatives A, B and Cm respectively. Whereas under Alternative D, available nest habitat will increase by 4 percent over the long term. While even-age final harvest activities will result in unsuitable goshawk nest habitat for up to 30 years, even-age thinning and selection harvest are expected to improve structural conditions preferred by the northern goshawk and by the year 2060, proposed treatments will improve structural conditions on 13 percent, 14 percent, 13 percent and 12 percent of suitable goshawk nesting habitat under Alternatives A through D respectively.

Motorized trails

Of all the woodland raptors found on the ANF, the northern goshawk is most sensitive to disturbance and any activity that increases human disturbance into suitable breeding ground has the potential to have adverse effects. Because of the noise and concentrated use during the breeding season, summer motorized trail use has the greatest potential to adversely affect nesting birds. Because all motorized use is restricted to Intensive Use Areas (IUAs), potential impacts to the northern goshawk are limited to these areas and Table 3-58 displays by alternative the number of currently active goshawk territories included within IUAs.

Presently IUAs with motorized use occur on approximately 15 percent of the Forest and this will remain unchanged under Alternative A. Lands included in IUAs will increase to approximately 18 percent and 15 percent of the Forest under Alternative B and Cm respectively and decrease to approximately 6 percent of the Forest under Alternative D. While direct effects to the northern goshawk could occur under any alternative, all alternatives include design criteria that restrict new motorized trail use within active territories and as a result there are not expected to be

Table 3-58. Goshawk territories within alternative IUAs

	Alternative A	Alternative B	Alternative Cm	Alternative D
Active Goshawk Territories	5	6	5	4

impacts from new motorized trails to active goshawk nests under any alternative. Alternatives B, Cm, and D all include increased protection of known territories and as a result potential risks to known nests will be reduced under these alternatives. Potential conflict with future use varies by alternative depending on the acreage of IUAs. Only Alternative D reduces potential risks between future motorized trail development and the northern goshawk. Risks to future use are increased somewhat under Alternatives B and Cm, due to the larger acreage included within IUAs.

Effects summary

While all alternatives have the potential to adversely affect the northern goshawk and its habitat, Forest-wide design criteria in place under all alternatives are expected to reduce potential impacts from proposed activities to a level that will allow continued use and successful reproduction of active nests and territories.

While the amount of suitable nesting habitat varies by alternative, all alternatives will provide landscape level nesting and foraging habitat conditions that Forest monitoring indicates is consistent with goshawk use.

All alternatives will maintain adequate habitat to meet forestwide populations objectives for the northern goshawk and while the amount and quality of suitable habitat varies by alternative, all alternatives will continue to maintain a predominance of suitable habitat across the landscape and ensure that the forestwide viability of this species is maintained. Also, ANF monitoring indicates that the level of activity proposed will continue to provide suitable habitat for the northern goshawk and as a result, all alternatives meet Forest goals and objectives related to providing habitat for species that utilize late structural and remote forest conditions, as well as mature forest species with viability concerns.

Cerulean warbler

Direct effects include any activity within suitable habitat that results in mortality and/or harassment leading to nest failure or mortality. Specific treatments include timber harvest, road and trail construction, oak release, and prescribed fire. Because the cerulean warbler is closely tied to oak and oak transition forests on the ANF and considering suitable riverine habitat is largely protected by design criteria under all alternatives, direct and indirect effects will focus on changes in the oak forest community.

Because this species utilizes mature forest conditions, any activity that eliminates mature oak forest has the potential to have adverse direct and indirect effects. These treatments include timber harvest, new road construction, gravel pit construction and opening construction. While all alternatives will result in removal of trees, new road construction and pit and opening

construction will result in small localized reductions in mature forest and will exist as a small inclusion within the larger forested landscape. Due to the small acreage proposed for treatment and considering Forest monitoring indicates that higher densities occur within stands that contain the canopy gaps created by these activities, potential impacts to cerulean warbler nesting are greatest from proposed timber harvest. Potential effects can be both positive and negative and vary with the amount and type of timber harvest proposed under each of the alternatives.

Because research, including Forest monitoring (Rodewald 2004, Stoleson *pers. comm.* 2005a) indicates that higher densities of cerulean warblers exist on sites that had recently received a partial harvest activity (described previously), it is anticipated that improved cerulean warbler habitat and increased densities of birds will occur on sites receiving oak shelterwood harvest, thinnings or uneven-aged treatments. The length of time the improved condition lasts will vary by treatment, for example, because oak shelterwood treatments are followed by a removal cut. The improved canopy conditions resulting from the shelterwood will last for 10 to 20 years, after which a removal cut will be implemented and the site will be made unsuitable for nesting (described below). The improved conditions resulting on sites receiving a thinning or uneven-aged treatment may last for a longer period of time, particularly under uneven- age management, due to the more frequent entries.

While partial harvest treatments can improve cerulean warbler habitat, final harvest activities including removal cutting can create unsuitable nesting habitat for up to 50 years due to the loss of the mature forest canopy following treatment. Although considered a final harvest treatment, cerulean warblers continue to use sites that have received a two-aged harvest, but at reduced densities (Miller *et al.* 1995) and as a result, sites that receive a two-aged harvest will continue to provide suitable cerulean habitat. Although removal cutting will eliminate suitable habitat until the stand matures, oak regeneration, in combination with associated reforestation treatments such as fire, are necessary to maintain oak on a site. As a result, final harvest treatments will increase retention of oak on the Forest and better provide for the long-term retention of preferred cerulean warbler oak habitat.

Long-term changes in cerulean warbler habitat are displayed by alternative in Table 3-59 and include total oak/riverine habitat, total nesting habitat, and total preferred nesting habitat.

Due to the conversion of oak to birch and red maple, which results largely from a lack of disturbance, all alternatives will result in a short- and long-term reduction in oak habitat with Alternative Cm maintaining the largest oak component (84% of existing oak) and Alternatives A, B and D, maintaining approximately 81 percent of the existing oak component. While Alternative Cm retains more oak than the other alternatives, due to increased levels of regeneration activities proposed under this alternative and Alternatives A and B, by 2060, Alternative D will maintain the greatest amount of cerulean warbler nesting habitat.

Table 3-59. Cerulean warbler alternative habitat changes

	2060			
	Alt. A	Alt B	Alt Cm	Alt D
Suitable oak/riverine habitat ¹	12.4	12.4	12.8	12.4
Suitable nesting habitat (mature oak/riverine) ¹	11.6	11.2	11.7	12.2
Preferred nesting habitat (mature oak/riverine <75% stocked) ²	31.2	33.2	35.3	28.3

¹ – expressed as % of the Forest² – expressed as % of suitable habitat

Presently, approximately 25 percent of the available oak habitat has the more open canopy conditions that would be expected to result in higher cerulean warbler densities, and although there have been some partial harvest treatments in oak, most of the existing open canopy conditions are naturally occurring. For the purpose of this analysis, it is assumed that similar levels of open canopy conditions will continue to occur and the amount of preferred nesting habitat identified in Table 3-59, represents 25 percent of the naturally occurring open canopy habitat combined with the acreage under each of the alternatives that receive a partial harvest treatment.

Cerulean warbler densities can be estimated by multiplying the acreage in preferred and suitable nesting habitat under each of the alternatives by the cerulean warbler density/acre observed in each of these habitats (Stoleson *pers. comm.* 2005a). While there is some variation in the number of pairs that each alternative could support, all alternatives will maintain adequate habitat to provide approximately 1400 to 1500 cerulean warbler pairs Forest-wide.

Landscape effects

Landscape level effects will be evaluated by looking at the potential for fragmentation related effects such as increased nest parasitism and predation as well as an evaluation of the predominate landscape condition that will be provided under each of the alternatives.

Forest fragmentation and its associated effects on wildlife are well documented (Robbins *et al.* 1989, Paton 1993, Webb *et al.* 1977) and in an effort to assess potential fragmentation related effects, the ANF established 20 breeding bird transects in 1992. One of the objectives of this monitoring was to determine the effects of timber harvest on breeding bird diversity. Sites sampled include a variety of forest types and conditions, including both managed and unmanaged forests. Sampled sites also had various levels of fragmentation, including highly fragmented areas of intensive oil and gas development and areas that are virtually unfragmented. In addition to these transects, the NE Forest Experiment Station has collected data on songbirds, small mammals and amphibians from over 50 sites across the Forest (deCalesta 1998) and this information will be used to assess potential effects to the cerulean warbler and other neo-tropical migrants.

When evaluating potential effects of fragmentation, landscape characteristics such as the amount of intact forested and non-forested habitat need to be considered. For example, while Robbins *et al.* (1989), identified a minimum tract size for a number of breeding birds, he found that for most area-sensitive species, the relationship between the probability of occurrence and area is significant only for forests that are greatly isolated (e.g. less than 33% forest within 2 km²). This is a consideration on the ANF due to the predominately forested nature of the landscape both within and surrounding the ANF. For example, nest parasitism is a well-documented edge-related effect in more fragmented landscapes with a large, non-forest component. However, breeding bird monitoring from 35 sites across the forest has documented fewer than 15 cowbirds out of 8,000 birds censused (deCalesta 1998). Although there may be localized areas of increased parasitism close to openings near private land inclusions, considering the low number of cowbirds in predominantly forested areas like the ANF, nest parasitism by cowbirds is not expected to have a significant effect on interior-forest songbirds such as the cerulean warbler. This is supported by other research in the northeast (Rodewald and Yahner 2001), which indicates that effects of fragmentation such as brood parasitism and nest predation may not occur or may be reduced in extensively forested areas such as the ANF, when compared to landscapes that are not predominantly forested. Also, after three years of songbird nest monitoring on the Forest, there has been no documented nest parasitism in any of the nests monitored. (Stoleson, *pers. comm.* 2006).

While nest parasitism is reduced in extensively forested landscapes such as the ANF, nest predation does occur and more recent research has indicated that edge effects such as increased nest predation occur in forested, as well as agriculturally dominated landscapes (Manolis *et al.* 2002). There is also research that shows that elevated populations of nest predators occur near edges of forest and non-forest, as well as near edges created through even-age regeneration harvest (Manolis *et al.* 2002, King *et al.* 1998, King *et al.* 1999). Although nest predation has been found to be higher near edges, effects on reproduction are complex. For example, Flaspohler *et al.* (2001) studied the effects of forest edges on ovenbirds (*Seiurus aurocapillus*) demography in a managed forest landscape where many of the forest edges are the result of clearcutting. While they found higher levels of nest predation near clearcut edges, nest density in edge habitat was 28.6 percent higher than in interior habitat. Also on average, birds nesting in edge habitat laid clutches that were 15.5 percent larger than clutches in interior habitat and they found that the apparent “ecological trap” resulting from the combination of relatively high nest density and low nest success in edge habitat was largely offset by the difference in mean clutch size between edge and interior habitat. Finally their model of habitat specific population demography indicates that ovenbirds breeding in northern hardwood forests are producing an annual surplus of offspring, which is consistent with the hypothesis that areas dominated by contiguous forest are source habitats for some forest interior species.

Monitoring conducted on the Forest to date shows that the eastern chipmunk (*Tamias striatus*) is the biggest nest predator on the ANF. Although this would vary somewhat by site, this is consistent with other research in predominately forested areas, which identified the chipmunk as the most common or one of the most common nest predators (King *et al.* 1999, Manolis *et al.* 2002, Flaspohler *et al.* 2001). Preliminary monitoring information also appears to support the complex relationship described above (Flaspohler *et al.* 2001). For example, the NRS has been monitoring canopy, shrub and ground nesting species for three years and while data collected to date indicates that high levels of nest predation can occur to shrub nesting species such as the black-throated blue warblers, nest success is higher in sites receiving timber harvest, than in uncut sites, indicating that higher nest densities in the treated sites may offset increased nest predation (Stoleson *pers. comm.*, 2006a).

As described previously, final harvest treatments on the ANF are considered temporary and deCalesta (1998) suggests that even aged timber harvesting, such as that proposed under all alternatives, will not result in forest fragmentation, but rather habitat fragmentation, and that the openings created through even-aged harvest are temporary. As a result, while proposed even-age regeneration treatments may result in increases in early successional species and an increase in nest predators, these effects are expected to be temporary in nature. Also it is anticipated that successful reproduction of forest interior species such as the cerulean warbler will continue to occur and that preferred site and landscape conditions will be maintained. This is supported by on-forest monitoring, where sites manipulated by even-aged forest practices similar to those proposed, contained a similar compliment of interior-forest songbirds, amphibians, and mammals when compared to uncut, second-growth and old-growth habitat (deCalesta 1998). Finally, the ANF has some of the highest densities of forest interior species in the State, including black-throated blue warblers, black-throated green warblers, blackburnian warblers and scarlet tanagers (Stoleson *pers. comm.* 2006), indicating that the existing forest management activities similar to those proposed will continue to provide suitable habitat for forest interior species such as the cerulean warbler.

While effects of forest fragmentation from proposed timber harvest are expected to be temporary in nature, long-term effects such as increased predation or competition may occur along permanent openings and new roads, which have breaks in the Forest canopy and a well defined herbaceous layer. Although this will vary by site depending on surrounding landscape conditions and associated predator populations. Proposed activities that may increase the amount of permanent edge and reduce interior habitat include opening and gravel pit construction and new road construction under all alternatives. In addition to the acreage affected by the treatments, it is expected that edge related effects such as increased nest predation may occur for an additional 300 ft into the Forest and that by 2060, these effects could occur on approximately 6 percent of the Forest under Alternative A, 5 percent under Alternatives B and Cm and 4 percent under Alternative D.

Considering roads have the greatest potential to cause fragmentation on the Forest, and in an effort to determine whether or not forest interior species such as the cerulean warbler utilize sites

with higher road densities, a GIS evaluation of sites that are known to be occupied by the cerulean warbler was done and occupied sites were compared with the forestwide availability of the varying road densities. This information is displayed in Table 3-60.

Information from Table 3-60 shows that while 83 percent of the occupied cerulean warbler habitat occurred at road densities below 4 mi/mi², occupied habitat occurred at a variety of road densities and at levels similar to the Forest-wide availability. This is consistent with work done by Stoleson (*pers. comm.* 2006) and indicates that road densities commonly found on the ANF do not preclude use of the Forest by forest interior species such as the cerulean warbler.

In addition to potential effects from fragmentation, the overall landscape condition needs to be considered. Using landscape codes identified previously, alternative landscape conditions that characterize suitable cerulean warbler habitat on the Forest are displayed by Alternative in Table 3-61.

Landscape codes 1 and 2 will be characterized in the future by predominately late structural conditions and 65 percent, 53 percent, 61 percent and 78 percent of the suitable cerulean warbler habitat will be managed with this landscape condition under Alternatives A, B, Cm, and D respectively. The reduced level of management that characterizes landscape codes 1 and 2 is partly reflected in the amount of new road construction proposed within suitable cerulean warbler habitat. For example, only 16 percent (maximum) of the total forestwide road construction proposed would occur in suitable cerulean warbler habitat.

Table 3-60. Road densities of occupied cerulean warbler habitat

Road Density (mi/mi ²)	Forest-wide Availability	Occupied Cerulean Warbler Habitat
<0.15	2%	6%
0.015-2.087	24%	21%
2.087-4.159	47%	56%
4.159-6.232	19%	11%
6.232-8.304	2%	2%
8.304-10.376	1%	4%

Table 3-61. Cerulean warbler habitat landscape conditions by alternative (% ANF lands)

Landscape Code	Alt. A	Alt B	Alt Cm	Alt D
1	22	51	59	67
2	43	2	2	9
3	34	42	32	17
4	<1	0	0	0
5	<1	7	7	7

Effects summary

Up to 6 percent of the Forest will be affected by permanent edge associated with proposed road and opening construction and potential impacts such as increased nest predation may occur on this area. While proposed timber harvest may increase levels of nest predation in the short term, it is anticipated that nest production of forest interior species such as the cerulean warbler will continue to occur at levels that support local and Forest-wide populations of this species.

It is anticipated that existing forest health concerns that presently threaten oak and oak transition stands will continue. Although it is difficult to predict the degree of impact from these stressors, particularly the cyclical populations of defoliating insects, droughts and introduced exotic pests, it is likely that some form of chemical, biological or cultural treatments will be necessary.

Preferred riverine habitat will be maintained under all alternatives and all alternatives will maintain over 80 percent of existing oak habitat as suitable cerulean warbler nesting habitat. Also, available habitat will be well distributed and will continue to exist in all watersheds where it presently occurs. As a result, all alternatives are expected to continue to provide the landscape conditions preferred by this species, as well as landscape conditions consistent with documented cerulean warbler use on the Forest.

While the amount and quality of suitable cerulean warbler habitat varies by alternative, all alternatives will continue to maintain a predominance of suitable habitat across the landscape and ensure that the Forest-wide viability for this species is maintained. Also, all alternatives will meet Forest-wide goals of providing habitat for species that require interior habitat conditions, including species with viability concerns.

Timber rattlesnake

Timber rattlesnake populations are declining throughout most of Pennsylvania primarily due to human-snake encounters and loss of suitable habitat (Urban 2005). Eight dens are known to exist on the ANF with the potential for a half dozen more (that were historically known to exist). Under all alternatives, Forestwide guidelines are designed to protect den sites with the goal of reversing the downward trend in populations. Efforts are underway to increase public awareness of the ecological value of rattlesnakes and the need to protect them. Under all alternatives the management emphasis is to maintain 20 to 60 rattlesnakes per den at 10 to 15 den sites by the year 2020.

Introduction to effects

This section will focus on the effects of activities as they apply to the primary threats to the timber rattlesnake. As stated above, these include loss of habitat, habitat fragmentation, and isolation of populations. Direct mortality caused by humans (including illegal snake hunters) and vehicle deaths will be assessed by levels of activities that increase human/snake encounters. Both short- and long-term effects will be evaluated, and for the purpose of this analysis, short term effects will be looked at by evaluating habitat conditions by the year 2020, whereas 2060 will be used as the point in time when potential long-term effects are evaluated.

Activities with effects

Based on the variety of habitats used by this species, the majority of timber harvest activities will continue to provide the forested settings necessary to support the timber rattlesnake. While this species is at home in timber-covered terrain, especially that of second-growth woodland, it also utilizes open forest edges, openings, meadows and open shrub-land edges. Clearcuts with reserves (groups of trees left standing) and areas of early structural vegetation are especially important for providing small mammals for foraging. Uneven-aged management, thinning, shelterwood seed cuts, clearcut with reserves and two-age harvesting may improve foraging and basking habitat by reducing dense canopy cover. Removal of overstory vegetation near potential and known den sites (during winter months) would improve den site conditions by preventing shade over and increasing basking opportunities. Most reforestation activities would restore habitat, but the benefits would be more evident in the long-term.

Herbicide treatments will not adversely affect rattlesnakes or their habitat. Alternative B proposes the most herbicide treatment (2,222 acres/year). Some researchers (Miller and Miller 2004) have theorized that following herbicide application there would be a reduction of seed from fruit-producing shrubs and herbaceous vegetation, which could reduce the food source for small mammals, particularly rodents, which could reduce the prey base for the timber rattlesnake. However, a study was conducted by the Northern Research Station, Forestry Sciences Laboratory on Responses of Wildlife Communities to Herbicide Application that does not support this theory. The assessment was conducted on 16-20 acre stands for 12 years, 2 years prior to herbicide application and 10 years following herbicide application. While data collation and analysis are still ongoing, the summary results to date are as follows: “Responses to treatments varied among taxa, probably based on their differing requirements for ground cover. Overall mammal species diversity was reduced by herbicide treatment, primarily due to its effects on shrews. In contrast, overall mammal abundance increased immediately following cutting, primarily due to a temporary increase in *Peromyscus* mice, the most abundant species. The results indicate that there were no effects of treatments on age ratios of the two most frequent mammal species, suggesting no impacts on demographic rates” and not a significant impact on prey of the rattlesnake.

Stone Pit Development/Expansion could be detrimental to individual basking snakes or denning populations if managers are not aware of denning sites. Underground crevices and dens can be accessed by a single hole on the surface and while this may be rare, areas that are being proposed for new excavation should be thoroughly surveyed. Also, stone pits provide optimal conditions for snakes to bask and if they are near a den the snakes found in a pit may be gravid females. If basking snakes are observed in existing stone pits, seasonal restrictions and mitigations should be implemented.

Effects by alternatives

Vegetation management

Direct killing of snakes by humans during random encounters continues to be a concern to resource managers. All timber harvest activities conducted during the summer season have the potential to increase human/snake encounters thus increasing the chance of purposeful killing or accidental killing by machinery.

There are several effects to the timber rattlesnake associated with timber harvest that will be influenced and measured by the levels of harvest proposed under each alternative. The effects to consider are: loss of habitat, habitat fragmentation and isolation of populations and direct mortality caused by humans and vehicles (including illegal snake hunters and poachers) as habitat is made more accessible by roads and human/snake encounters increase.

While the clearcut, and shelterwood removal methods of harvest may be indirectly beneficial in that prey sources could increase for a period of time, they also would likely reduce the canopy cover to less than preferable levels, especially where basking sites occur. However, this is a short-term effect because the forest stand would mature over time and become suitable once again and would not cause a detrimental decline in rattlesnake abundance. The amount of early structural vegetation, resulting from overstory tree removal, proposed to be created by the year 2020 ranges from 4 to 9 percent (Table 3-50). In the long term (2060) between 3 and 14 percent of the ANF would provide early structural conditions, respectively. All other vegetation management practices would not have a measurable effect on habitat used by the timber rattlesnake.

This snake is at home in timber-covered terrain, especially second-growth woodlands in mature or late structural forest stages. Acres managed for late structural forested habitat vary by alternative. The percentage of lands managed for late structural habitat by 2020 is 8 percent under Alternative A, 10 percent under Alternative B, 10 percent under Alternative Cm, and 9 percent under Alternative D. By 2060 the amount of late structural forest would vary from 24 percent of National Forest land in Alternative A, 25 percent in Alternative B, 28 percent in Alternative Cm, and 39 percent in Alternative D (Table 3-50).

It is unlikely that timber harvest activities would fragment rattlesnake habitat to the point where populations would become isolated under any alternative. Timber harvest and related activities are relatively small scale, well distributed across the forest and are temporally spaced. In addition, Management Area 2.2 (under Alternatives B, Cm and D) is proposed to be managed specifically for connectivity between core areas with late structural and old growth characteristics. These connectors would reduce the impacts of fragmentation and would provide the timber rattlesnake opportunities to migrate during the spring and fall within a somewhat undisturbed forested setting with fewer roads. These corridors would also provide optimum foraging areas because other species, such as rodents, would benefit from little disturbance. Acres managed for connectivity and core areas for the planning period are proposed on 0 percent (connectivity) and 7 percent

(core) of the ANF under Alternative A, 19 percent and 8 percent under Alternative B, 23 percent and 11 percent under Alternative Cm and 25 percent and 15 percent under Alternative D.

Additional protection for timber rattlesnake habitat will be provided during timber harvesting and other activities through the implementation of the following:

The 1986 Forest Plan (Alternative A) contains standards and guidelines which state:

- Habitat of endangered, threatened, and Forest Species of Concern will be protected or enhanced.
- Enhance rattlesnake denning and basking sites by release cutting.
- New roads, trails, recreation facilities and other developments will be located to avoid the following: rocky areas on southern and southeastern exposures suitable for snake dens.
- Existing ORV and foot trails will be managed to avoid conflicts between the public and “Species of Special Concern in Pennsylvania.” As an alternative, the trail will be relocated to provide the protection required for these species.
- Local roads will be closed to public use when necessary to provide additional protection for the bobcat and rattlesnake.

The LRMP includes either Forest-Wide standards or guidelines under Alternatives B - D that allow for seasonal restrictions, road and trail closures and other conservation measures for species with viability concerns. In addition, the following are specific guidelines for rattlesnakes:

- Known den sites and basking areas should be protected with a 450-foot buffer zone. Within this zone, new trails, roads, and log landings should be prohibited. Protect the integrity of the den site by not moving rocks larger than 2 feet in diameter and by not creating excessive soil compaction.
- Timber harvest may be permitted between November 1 and March 31 within the buffer.

Prescribed fire is not identified (in current literature) as a primary threat to the timber rattlesnake or its habitat and there is little research on the effects of prescribed fire. However, ground fires have the potential to harm individuals that do not move away from the area. The majority of prescribed fires on the ANF would occur prior to rattlesnakes emerging from the den. A prescribed fire that occurs after April 15th could adversely affect individuals if conducted in suitable habitat. Prescribed fire may result in enhanced growth of the understory, which could be beneficial for prey species. The average annual amount of prescribed fire proposed in the first two decades for silviculture, wildlife and hazardous fuels management under Alternative A is 280 acres (the lowest), 650 acres under Alternative B (the highest), 564 acres under Alternative Cm, and 358 acres under Alternative D (Table 2.2).

Road and trail management

The risk for human/snake interaction and harm to individual snakes is increased where roads or trails occur in suitable habitat. Road construction varies across the Alternatives and is based on levels of other resource activities, specifically vegetation management. Estimated annual averages, through the planning period, for road construction in existing corridors and new road construction is 13 miles and 8 miles respectively under Alternative A, 14 miles and 7 miles under Alternative B, 13 miles and 5 miles under Alternative Cm, and 11 miles and 5 miles under Alternative D (Table 2.2).

Habitats with minimal human activity are often characterized as remote. Like core habitat, remote habitat is often measured by the presence of roads and trails. The Forestwide Roads Analysis (USDA 2003b) identified eight unroaded areas on the ANF > 500 acres with a wildlife index of 26 or greater. These eight areas represent high quality remote habitat. Each unroaded area was evaluated against six criteria to determine an index for the wildlife values associated with each area. The highest possible score for all six criteria is 30. A description of the criteria can be found on pages 50 and 51 of the Forest-wide Road Analysis. There are 33,006 acres of unroaded habitat across the ANF. The percentage of high quality remote habitat that will remain relatively free of new Forest Service roads and trails (through the planning period) is 63 percent under Alternative A, 81 percent under Alternative B, 88 percent under Alternative Cm and 99 percent under Alternative D.

These areas would provide relatively undisturbed, remote habitat for the rattlesnake and decrease the occurrence of human/snake encounters.

Roads, trails, and other disturbances that remove forest ground cover interfere with mating behavior in snakes. Male snakes searching for females follow the phomonal trails of the females. Using their forked tongues, males detect the pheromones of females on the vegetation. When roads and trails remove vegetation the ability of males to detect and follow females is disrupted (Shine *et al.* 2004).

Animal mortality, a significant direct effect, can occur when off-road vehicles hit ground-dwelling animals, destroy birds and small mammals or cause the collapse of needed burrows or crevices. Although animal mortality is an obvious and familiar direct effect, displacement, avoidance and disturbance at specific sites, often associated with breeding and raising young, are the most commonly reported direct effects of motorized trails on wildlife (Kassar 2005). Intensive Use Areas and Equestrian Use Areas also increase the chance of human/snake encounters, ATV/OHM/snake encounters and horse/snake encounters, which increases the chance of snakes being purposely and/or accidentally killed. Twenty-five percent of known dens on the ANF are within IUAs. Alternative B includes the largest acreage in IUAs resulting in the highest risk of ATM/OHM-- rattlesnake encounters. Alternative D has the least acres in IUAs (Table 3-85). Alternative A provides the largest amount of open equestrian riding resulting in the highest risk of equestrian-rattlesnake encounters. Alternative D has no open riding.

Mourning warbler

Effects by alternative

Because the mourning warbler utilizes early successional vegetation associated with both canopy and understory disturbance, proposed activities that would affect habitat for this species include timber harvest, new road and opening construction, herbicide application and prescribed burning. Since most of the understory treatments are used in association with timber harvest, effects will be evaluated by looking at the amount and type of structure provided under each of the alternatives.

Early structure resulting from even-age regeneration harvest

Forest monitoring indicates that mourning warblers first come into a site after the shelterwood harvest because of the understory development that occurs following treatment. As a result, sites receiving a shelterwood treatment could be expected to have low densities of mourning warblers as they begin to occupy the site. Typically, a final harvest treatment occurs within three to five years of the shelterwood, which creates the dense layer of shrubby vegetation preferred by this species and as a result, higher densities would be expected to occur following the final harvest treatment. As described previously, the dense low-growing woody vegetation that results following the final harvest is temporary in nature and while higher densities of mourning warblers can be expected to occur on a site within 2 and 10 years of a final harvest treatment, suitable mourning warbler habitat would be eliminated within 15 to 20 years of the final harvest, as preferred low-growing vegetation is over-topped. As a result, the amount of early structural mourning warbler habitat created through even-age management is ephemeral in nature with lower densities occurring for three to five years prior to and 10-15 years following final harvest and higher densities occurring 2 to 10 years following harvest. Due to the closed canopy conditions that exist, a site is considered unsuitable within 20 years of the final harvest, although this would vary somewhat by site.

Multi-age structure habitat

Multi-age structure habitat resulting from uneven-aged management differs in both the type of habitat provided, as well as in the length of time it remains suitable. While mourning warbler habitat would be created on the entire site receiving traditional uneven-aged management, higher densities would be expected to occur within and adjacent to those portions of the stand that receive a group selection cut (approximately 20% of the site) and generally it would be expected that lower densities of mourning warblers would occur between groups (on approximately 80% of the site). Although in areas of high deer density, it is unlikely that the areas between groups would contain any mourning warblers, due to suppression of the shrub component. While habitat created through even-age harvest has a 20-year life span, because of the more frequent re-entry period (20 years) associated with uneven-aged management, suitable mourning warbler habitat within the site could remain for decades. As a result, although densities may be lower, mourning warbler habitat created under uneven-aged management may remain suitable in the long-term and would not be ephemeral in nature.

Table 3-62. Alternative mourning warbler habitat

Habitat	2020				2060			
	Alt A	Alt B	Alt Cm	Alt D	Alt A	Alt B	Alt Cm	Alt D
Percent of Forest in Early Structure created through even-age final harvest	8.9	8.7	7.3	4.3	12.9	11.6	9.6	2.4
Percent of Forest occurring in Early structure through group selection harvest ¹	<1	0.1	0.1	0.1	<1	0.5	0.7	2.0
Percent of Forest considered preferred mourning warbler habitat ²	8.9	8.8	7.4	4.4	13.0	12.1	10.3	4.4
Percent of Forest in Multi-age Structure created through uneven-aged management	0	0.6	0.6	0.6	<1	2.7	3.3	10

¹ includes 20% of acreage treated by uneven-aged management.

² acreage used to calculate densities

Table 3-62 displays early structure habitat, or the amount of regenerating forest created through even-age management and associated reforestation treatments and multi-age structure, or the amount of Forest that contains a mix of early, mid and late structural conditions that result from uneven-aged management and associated reforestation activities.

Approximately 8 percent of the ANF occurs as early structural habitat and in the short term this would be maintained under Alternatives A, B, and Cm, and decreased under Alternative D. In the long term, early structural habitat would increase by 61 percent, 48 percent, and 21 percent under Alternatives A, B, and Cm, respectively, and decrease by 44 percent under Alternative D. While preferred habitat will be created through even-aged vegetation management, it is anticipated that only those portions of the site that receive a group selection harvest will have higher densities of nesting birds, although lower densities may occur between groups if deer browsing is low.

Because mourning warblers respond to the edge habitat created by new road and opening construction, in addition to habitat created through timber harvest, it is expected that suitable habitat would be created on another 1 percent to 2 percent of the Forest under all alternatives due to proposed road and opening construction.

Effects summary

Using the average mourning warbler densities observed within harvested stands (13.6 pairs/100 acres, Stoleson, *pers. comm.* 2006b) on the Forest, by 2060, it is estimated that preferred habitat conditions created through timber harvest would support approximately 9,000, 8,000, 7,000 and 3,000 pairs of mourning warblers under Alternatives A, B, Cm, and D respectively.

Suitable mourning warbler habitat associated with existing roads and utility ROWs will continue to be available. Additionally, naturally occurring disturbances that open up the forest canopy, as well as disturbances that result from native and exotic pests would be expected to continue to create suitable mourning warbler habitat. However, development of understory vegetation required by this species is largely dependent on the size of the deer herd and suitable habitat will

only be created if the deer herd is low. While the amount of habitat created varies by alternative, it is expected that naturally occurring habitat, combined with the suitable habitat created through management, will continue to occur at levels that support local and Forest-wide populations of this species. Finally, based on the analysis presented above, all alternatives will maintain adequate habitat to meet Forest goals related to providing habitat for game species and early successional species with viability concerns.

Aquatic invertebrates

Direct and indirect effects to aquatic invertebrates will be evaluated by examining the effects of vegetation management, road construction and management, and ATV/OHM trails. As an MIS, the objective is to maintain the diversity and relative abundance of the population that existed before initiation of a land-disturbing activity. To validate the effects conclusions under the subsections that follow, aquatic invertebrates will be assessed at selected sites where proposed land-disturbing activities have the potential for causing impacts. Through the use of established methods, and depending on the circumstances and timing of the activity, aquatic invertebrates could be surveyed before, during, and after an activity to assess the effectiveness of Best Management Practices, Forest Plan standards and guidelines, or site-specific mitigation measures.

Effects by alternative

Vegetation management

Various activities associated with managing vegetation have the potential for indirectly affecting aquatic invertebrates where the activity is located in close proximity to a stream. Runoff from logging activities that reaches a stream has the potential to affect habitat and embed cobble-size particles. Cobble substrate generally supports the highest number of individuals and species because of more open space for increased numbers to occur.

Other activities that could occur from logging include the removal of shade-producing trees near or along a stream that can cause streams to warm and cause a shift in the types of species present. The removal of these trees can also lead to a long-term loss in potential large wood input to streams, thus the creation of a diversity of habitats could be limited in certain sections of streams. In addition, a reduction in leaf litter input, a primary source of nutrients for aquatic insects, could change the composition of species in a section of stream.

The use of herbicides is another activity that has the potential to affect aquatic insects if it were to enter a stream. Herbicides are not only proposed for use in reforestation, but for treating non-native invasive plants, for meeting wildlife objectives, and for meeting visual quality objectives. The Wildlife and Aquatic Species Risk Assessment (Appendix G2) shows that there is no significant risk to wildlife or aquatic species exposed to either glyphosate or sulfometuron methyl when properly applied.

The potential for any of the affects to occur is highest where the most land is allocated to allowing vegetation management. This potential is highest, and similar, in Alternatives A and B,

and slightly less in Alternative Cm. Alternative D provides a much lower harvest rate and herbicide application and thus the potential for effect to occur are the least. However, in all alternatives, numerous LRMP standards and guidelines related to protecting aquatic resources would be implemented. As a result, there would be no anticipated decline in the aquatic invertebrate population, including the diversity and relative abundance. The primary guideline that would prevent any of these affects to occur is the implementation of buffer strips related to logging and the application of herbicides.

Road construction and management

The effects from this activity are similar to that described for Rivers, Streams, and Impoundments. Dirt and gravel roads constructed within 300 feet have the highest potential for contributing sediment to a stream. These roads can become a long-term source of sediment and result in the embeddedness of cobble substrate, habitats important for aquatic invertebrates.

The alternative with the highest potential of this occurring is Alternative A with 7.1 miles of new road construction occurring within 300 feet of a stream, and the least potential in Alternative D (4.3 miles) by 2060. Localized effects to a stream population could occur during, and for a short period following, construction. It is possible that existing populations could be reduced during this short period, but would likely re-populate once a newly constructed road has stabilized and is maintained. If roads are not maintained to a higher standard in more sensitive areas, populations could remain reduced. To minimize this potential effect in all alternatives, LRMP standards and guidelines, as well as any site-specific mitigation measures, would be implemented.

Motorized ATV/OHM trails

Like the road construction and management section, the effects described for rivers, streams, and impoundments is similar. Assuming the effects are proportional to the number of acres available for development of trails, Alternative B has a much higher potential for effects to occur. This is followed by Alternative A, Alternative Cm, and Alternative D. Using this rationale, Alternative D would pose the lowest potential risk to aquatic insect populations.

Depending on the trail location, there could potentially be more effects because of the high use the trails receive and the constant generation of fine sediment that is more erodable and that can reach a stream. Where trails will contribute runoff to a stream, local aquatic invertebrate populations could have reduced diversity and/or relative abundance depending on site conditions, the amount of trail use, and the level of maintenance. To minimize this potential effect in all alternatives, LRMP standards and guidelines, as well as any site-specific mitigation measures, would be implemented.

Habitat indicator 5 – Amount and trends in habitat for game species

Effects to game species habitat are influenced by the amount of early structural habitat, availability of mast from oak, beech, black cherry, and other species, and the impacts of human disturbance (primarily roads and motorized trails) on winter ranges and brood rearing habitat.

Effects by alternative

Early structural habitat will increase by 2060 under all alternatives except Alternative D (see structural habitat section). This increase will benefit deer, bears, grouse, woodcock, and to a lesser extent, turkeys. Under Alternative D, the quality and quantity of habitat for game species would generally decline from present conditions because of the decrease in early structural habitat.

Oak forests are important for a variety of game species including white-tailed deer, black bears, wild turkeys, ruffed grouse, squirrels, and others. As described in the section on Oak Forests, all alternatives would promote management of oaks to regenerate oak stands and enhance acorn production. An oak component will be provided on 15 to 20 percent of the ANF under all alternatives

Conifer habitat will be managed similarly under all alternatives providing winter thermal cover for deer and turkeys. A conifer component will be provided on a minimum of 10 percent of the ANF. Species that utilize conifer such as the barred owl, black-throated green warbler, great blue heron, hermit thrush, and magnolia warbler would find similar conifer habitat under all alternatives.

Riparian management guidelines are similar under all alternatives, ensuring that these systems remain intact to support the needs of waterfowl, furbearers, and game fish. Buzzard Swamp, which is managed for waterfowl, game birds, furbearers and other wildlife in cooperation with the PA Game Commission, is managed the same under all alternatives.

Permanent wildlife openings will occur on a variety of ecological land types on 2 percent of the ANF under all alternatives. These openings provide brood rearing habitat for wild turkeys, and ruffed grouse, late-fall foraging habitat for turkeys, and early spring foraging for deer. Openings in bottomland ELTs, such as the Beanfields, Hall Farm, and Buzzard Swamp provide food and cover for American woodcock under all alternatives. Maintaining alder and crab apple thickets and other shrub habitats that provide breeding, nesting, and brood rearing habitat for woodcock will occur as a wildlife enhancement treatment under all alternatives. Old farm habitats such as the Economite Farm, Scott Farm, and Hall Farm will continue to be managed as grass, shrub, and early structural habitat to benefit both game and non-game species.

Landscape diversity

Black bear, turkey and deer are all landscape level species and have seasonal food and cover requirements that are best met within landscapes that have higher levels of horizontal diversity. The amount of horizontal diversity provided under each of the alternatives is displayed in Table 3-51 and Table 3-20. Because of the greater distribution of structural stages that are provided, landscape conditions 3 and 4 (MA 1. 3.0, 6.2, 7.2, and 8.6) would be expected to provide greater horizontal diversity. When compared by alternative, approximately 67 percent of the landscape under Alternatives A and B and 59 percent of the landscape under Alternative Cm would provide a high level of horizontal diversity preferred by many game species. Although Alternative D contains a greater amount of late structural stages and vertical diversity than the other alternatives, it is estimated that only approximately 26 percent of the landscape under this alternative will have higher levels of horizontal diversity preferred by deer, bear and turkey.

Effects of motorized recreation

The LRMP includes forestwide design criteria that require that new roads and trails to be located to avoid deer and turkey winter ranges and turkey brood rearing habitat. While both of these activities have the potential for adverse effects on wildlife, effects of new roads are mitigated by restricting access and associated disturbance during critical periods. Because of the use and noise associated with dispersed motorized use (snowmobiles, ATVs, trail bikes), and considering this use can occur during critical periods of the year and/or affect key habitat for species such as deer and turkey, potential conflicts between alternatives were evaluated.

While final layout of each project will be determined at the site level, the potential for conflict between alternatives varies depending on how much key habitat could be affected, as well as by the maximum amount of trail that could be constructed. Because all motorized trail must be developed within IUAs, an assessment of IUAs by alternative was completed in an effort to identify which IUAs had the greatest potential for conflict with key turkey and deer winter range. Figure 3-12 displays the estimated amount of winter range that will occur within the proposed IUAs.

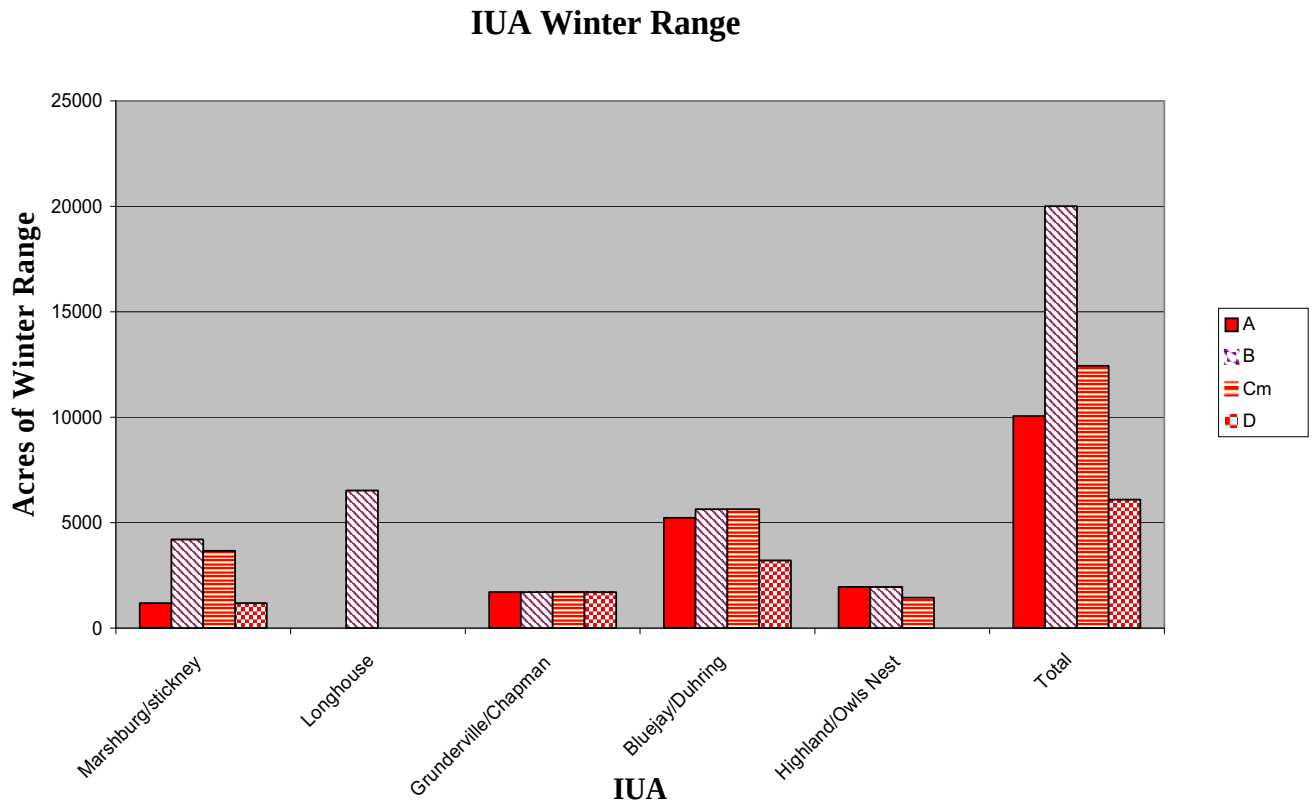


Figure 3-12. Acres of deer and turkey winter range in each intensive use are by alternative.

Table 3-63. Estimated intensive use area trail miles and density by alternative.

IUA	Alternatives							
	A		B		Cm		D	
	Trail Miles*	Trail Density**	Trail Miles	Trail Density	Trail Miles	Trail Density	Trail Miles	Trail Density
Marshburg/Stickney	55	2.4	83	2.4	61	2.3	41	2.3
Longhouse	0	0.0	41	1.6	0	0	0	0
Grunderville/Chapman	22	1.9	22	1.8	22	1.8	10	1.7
Bluejay/Duhring	38	0.6	61	0.9	57	0.8	30	1.5
Highland/Owls Nest/Twin Lakes	37	1.4	26	0.9	14	0.7	0	0

* – Maximum trail miles.

** – Expressed as the maximum miles of trail/sq mile of IUA.

The potential conflict between motorized trail development and turkey winter range is highest under Alternative B, and the amount of winter range potentially affected will increase. The Longhouse IUA has the greatest potential for conflict between motorized use, because of the large amount of key winter range contained within this IUA (6500 acres).

The amount of trail proposed under each of the alternatives will also influence the potential for conflict between key areas such as turkey brood habitat. Because brood habitat, or for that matter other unique wildlife habitat cannot be accurately identified at the ANF scale, potential conflicts between motorized use and IUAs can be relatively evaluated by looking at the maximum trail density that will occur within the individual IUAs under each of the alternatives (Table 3-63). The maximum trail miles that will occur within each of the IUAs is displayed in Table 3-85. A summary of anticipated effects within each of the IUAs follows.

Marshburg/Stickney – The potential for conflict between trail development and brood habitat or other key wildlife habitats is greatest within this IUA because of the higher trail density and because this IUA contains up to 36 percent more trail than the largest IUA (Bluejay/Duhring). Although the trail density within this IUA will not change by alternative, the greatest potential impact to wildlife habitat will occur under Alternatives B and Cm, due to the larger amount of turkey and deer winter range potentially affected.

Longhouse – This is a new IUA proposed under Alternative B. Because it contains the largest amount of deer and turkey winter range of any of the IUAs, the potential for conflict with turkey and deer is high.

Grunderville/Chapman – This is the smallest of the IUAs and has the fewest acres of winter range. Much of this area also receives intensive oil and gas and as a result is generally less preferred habitat for species such as turkey. There is virtually no change in the trail density or the amount of winter range affected between alternatives. Although Alternative D shows a higher trail density than Alternatives A-Cm because of the reduction in IUA size, the amount of trail will be reduced by half and potential effects to wildlife would also be expected to be reduced.

Bluejay/Duhring – There will be a small increase in the amount of winter range affected under Alternatives B and Cm because of inclusion of the Salmon Creek drainage. Trail density may also increase by 61 percent and 50 percent under Alternatives B and Cm respectively and it would be anticipated that potential conflicts with wildlife would increase as well. Although the trail density increases under Alternative D, the total miles of trail and potential conflicts with wildlife will be reduced from the present condition.

Highland/Owls Nest/Twin Lakes - Although the size of this IUA will increase under Alternatives B and Cm, potential conflicts with game species are expected to decrease from the present condition under all alternatives, due to the reduction in trail construction.

Game birds

Early structural habitat is the primary habitat utilized by ruffed grouse and American woodcock on the ANF. As stated above, a variety of permanent openings and old farm habitats throughout the ANF will be managed to provide habitat for game birds under all alternatives.

Management Area 1.0 specifically emphasizes short rotations to provide early structural habitat for ruffed grouse. Alternative A provides about 8,000 acres in MA 1.0, Alternative B about 7600 acres, Alternative Cm about 7,900 acres and D about 6200 acres. The total amount of early structural habitat under each alternative is presented in Table 3-50 with Alternative A having the most and Alternative D providing the least.

Game fish

Activities that increase sedimentation and reduce water quality can be detrimental to game fish habitat. Some streams have higher quality game fish habitat (e.g. Class A Trout streams) or provide a remote fishing experience (e.g. Wilderness Trout Streams, Wilderness Areas).

Recreation

Several areas of the ANF are proposed for Intensive Use Areas where motorized off-highway vehicle trails can be constructed. These areas are located where headwater streams occur, several of which support brook trout populations. In particular, a Class A Wild Trout stream is located within the proposed Longhouse IUA in Alternative B. Where a stream does not support a population, it contributes to downstream water quality where fish typically become more abundant and diverse.

During the implementation of the current 1986 Forest Plan, a better understanding of the effects that trails can have on streams was developed between various resource specialists that have led to the improvement of many miles of trails. These improvements, identified after trail monitoring, include such things as using a harder stone surfacing in more sensitive areas, re-routing sections of trails, conducting maintenance more frequently, improved culvert placement, among others. This has led to a further reduction of fine sediment from trails.

Assuming the effects are proportional to the number of acres available for development of trails, Alternative B has a much higher potential for effects to occur. This is followed by Alternative A, Alternative Cm, and Alternative D. Using this rationale, Alternative D would pose the lowest potential risk to aquatic species and their habitat. To address any future trail construction in any alternative, Forest Plan standards and guidelines and/or site-specific mitigation measures would be implemented to protect fish habitat in streams.

Alternative B has the potential for more effects based on acreage, but in particular because it also would encompass Fourmile Run, a Class A Wild Trout stream. Flowing through the middle of this IUA is one of only three Class A Trout streams (as designated by the Pennsylvania Fish and Boat Commission) on the ANF, and only one of two based on native brook trout. The third stream is based on wild brown trout. Fourmile Run, is located in an area of the ANF where little oil and gas management activity has occurred, and where recent vegetation management was conducted with extraordinary mitigation measures to protect the stream. Portions of the most recent timber sale were harvested with a helicopter in a portion of the Fourmile Run watershed to avoid building any additional stream crossings in the watershed because of its unique character. Considerable effort has also been made in the past to provide harder stone surfacing on existing stream crossings and for timber harvesting to occur further away from the stream than is required in the Forest Plan. Combined, the three Class A Trout waters make up approximately 1.4 percent of perennial streams on the ANF. Although Forest Plan Standards and Guidelines and site-specific mitigation measures are implemented, the potential for reducing the quality of this fishery is high for Alternatives B, with no effects for Alternatives A, Cm, and D. The high risk given for Fourmile Run is because the stream just meets the Class A Trout stream requirement, and small effects could cause it to drop below this level. Although Fourmile Run and its tributaries are a dominant feature that bisects the Longhouse IUA, some trail could be constructed outside the watershed that would not impact the Class A trout fishery.

Wilderness

Some of the higher quality native brook trout streams on the ANF would be included in the Allegheny Front Wilderness Study Area in Alternative D. Three of the streams support very good to excellent trout fisheries, with an ability to support higher than normal abundances of reproducing trout when compared with other cold headwater streams on the ANF. This area is currently in the National Recreation Area where there is little to no land-disturbing activities and provides approximately 18.4 miles of perennial and intermittent streams. The streams also provide good water quality to the Allegheny River where numerous game fish, federally listed mussel species and RFSS fish occur.

Minister Creek Valley, included in Alternatives Cm and D as a proposed Wilderness Study Area, provides approximately 23.9 miles of perennial and intermittent streams. These streams provide suitable habitat for brook trout and other aquatic species. The majority of the mileage is within the Minister Creek drainage which includes approximately 18.8 miles of perennial and intermittent streams. Minister Creek is part of Pennsylvania-Department of Environmental Protection's water quality network sites in the state and was selected as a reference site because of its high aquatic qualities. Alternatives Cm and D would provide a large amount of land in an undisturbed condition that would eliminate possible effects to water quality and aquatic habitat from Forest Service surface disturbing activities.

Additionally, any streams within Wilderness Areas would provide the angler with the opportunity to fish for native brook trout and wild brown trout in a remote setting requiring walk-in access. A portion of the public seeks this type of opportunity. A wilderness designation would perpetuate this experience.

Fisheries in impoundments and reservoirs would not change by alternative. Habitat for walleye, small mouth bass and other game fish that inhabit reservoirs and impoundments would be provided similarly under all alternatives.

Habitat indicator 6 - Species with viability concerns

A viability outcome was determined for each of the 78 species identified during the species viability evaluation process. A range of five viability outcome levels was developed for use by Eastern Region National Forests to facilitate the comparison of species viability under each alternative in forest plan revision. The viability outcome should be thought of as an index of the capability of the environment to support population abundance and distribution, but not as an actual prediction of population occurrence, size, density or other demographic characteristics. A viability outcome is a judgment, based on scientific information found in the literature and from discussion with taxonomic experts and it does not make a yes-or-no determination of viability. It is important to note that the concept of ecological conditions, distribution and quality must be based on the knowledge of the species distributional range and life history. For example, some species may have received a viability outcome level of D or E. The reader must realize that many plants and animals occur in a localized or patchy distribution, and thus would never occur in the conditions described in outcome levels A, B, or C. The uncertainty associated with determining outcomes is acknowledged.

We used the following analysis scales: 1) to summarize conditions on ANF lands within the proclamation boundary; and 2) to summarize existing conditions on all lands within the proclamation boundary (number 2 discussion is found in the cumulative effects section).

Viability outcomes based on ANF lands

These outcome descriptions were used for determining present condition and direct and indirect effects in the short term (2020) and long term (2060) by alternative for ANF lands within the proclamation boundary.

Outcome A. Suitable ecological conditions are broadly distributed and of high abundance across the historical range of the species within the planning area. The combination of distribution and abundance of ecological conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.

Outcome B. Suitable ecological conditions are either broadly distributed or of high abundance across the historical range of the species within the planning area, but there are gaps where suitable ecological conditions are absent or only present in low abundance. However, the disjunct areas of suitable ecological conditions are typically large enough and close enough to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the planning area.

Outcome C. Suitable ecological conditions are distributed frequently as patches and/or exist at low abundance. Gaps where suitable ecological conditions are either absent, or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical within the planning area may have resulted from this isolation.

Outcome D. Suitable ecological conditions are frequently isolated and/or exist at very low abundance. While some of the subpopulations associated with these ecological conditions may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition within the planning area may have resulted from this isolation.

Outcome E. Suitable ecological conditions are highly isolated and exist at very low abundance, with little or no possibility of population interactions among suitable environmental patches, resulting in strong potential for extirpations within many of the patches, and little likelihood of re-colonization of such patches. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.

Changes in outcomes by alternative

Species are grouped by primary habitat and results are summarized in Table 3-64. The outcomes for all species are provided in Appendix E. Outcomes do not change by alternative for species that utilize primarily mid to late structural oak habitat, aquatic habitats, riparian/wetland habitats or grassland/seedling/sapling habitats for either the short (2020) or long term (2060). For mid-late structural forest, there is one species, the timber rattlesnake, that has a reduced outcome for NFS lands in the long-term (2060) under Alternatives A, B and Cm. The current status of this species is that it has declined from historic numbers and continues to decline across Pennsylvania. There

is currently suitable denning, foraging and basking sites on the ANF but they are broadly distributed and the species is uncommon. The outcome for the present condition of the timber rattlesnake is C.

In the short term (2020), for all alternatives, suitable habitat is sometimes isolated and the timber rattlesnake occurs at low abundance. Small gaps in the habitat may occur causing some isolation of subpopulations. Most subpopulations can interact, specifically in the southern half of the ANF, although interaction between the northern ANF subpopulations and southern ANF subpopulations may be limited.

By the year 2060, the magnitude of adverse impacts from road and motorized trail construction and other human activities on the timber rattlesnake increases to the point where the viability outcome changes. The amount of new FS road construction within new road corridor ranges from 152 to 344 miles (Table 3-71). The result is that suitable habitat is frequently isolated with large habitat gaps. Most subpopulations are isolated with limited opportunity for most subpopulations to interact. The result is a viability outcome of D for both NFS lands and all lands in 2060.

The viability outcome for the timber rattlesnake is not projected to decline in Alternative D for NFS lands as it is in Alternatives A-Cm. The viability outcome for this species will remain unchanged from the present outcome for NFS lands under Alternative D. When compared to Alternatives A, B, and Cm, Alternative D provides: 1) fewer FS roads, 2) fewer miles of motorized trail and fewer IUAs, 3) improved landscape connectivity and core habitat, 4) increased availability of preferred late structural and remote habitat and 5) no open equestrian riding. Collectively, these changes are expected to create more suitable ecological conditions and help to facilitate dispersal and interaction among subpopulations.

Aquatic species outcomes would not change as a result of Forest Service activities because Forest Plan standards and guidelines and/or site-specific mitigation measures to protect aquatic species would be implemented on activities that could potentially have an affect.

Table 3-64. Species with viability concerns – outcomes by primary broad habitat by alternative for direct and indirect effects

	Existing Condition (number of species)	Direct and Indirect Effects – 2020 (number of species by alternative)				Direct and Indirect Effects – 2060 (number of species by alternative)			
		A	B	Cm	D	A	B	Cm	D
Mid-Late Structural Forest									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	8	8	8	8	8	8	8	8	8
Outcome C	4	4	4	4	4	3	3	3	4
Outcome D	7	7	7	7	7	8	8	8	7
Outcome E	0	0	0	0	0	0	0	0	0
Mid-Late Structural Oak Forest									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	1	1	1	1	1	1	1	1	1
Outcome C	1	1	1	1	1	1	1	1	1
Outcome D	1	1	1	1	1	1	1	1	1
Outcome E	0	0	0	0	0	0	0	0	0
Aquatic (rivers, streams and impoundments)									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	13	13	13	13	13	13	13	13	13
Outcome C	23	23	23	23	23	23	23	23	23
Outcome D	1	1	1	1	1	1	1	1	1
Outcome E	0	0	0	0	0	0	0	0	0
Riparian/Wetlands									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	2	2	2	2	2	2	2	2	2
Outcome C	2	2	2	2	2	2	2	2	2
Outcome D	10	10	10	10	10	10	10	10	10
Outcome E	1	1	1	1	1	1	1	1	1
Grassland/Seedling/Sapling									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	0	0	0	0	0	0	0	0	0
Outcome C	0	0	0	0	0	0	0	0	0
Outcome D	3	3	3	3	3	3	3	3	3
Outcome E	1	1	1	1	1	1	1	1	1

Migratory birds

At the landscape level, all alternatives provide sufficient early, mid, and late structural habitat to support current populations of migratory birds. Forestwide guidelines have been developed to provide additional conservation for specific species or specific activities. For example:

Since many high priority grassland nesting songbirds can raise two or more broods in a single season, maintenance activities in large grasslands greater than 75 acres should be limited to outside the nesting season (April 15 to September 15) unless the site has been surveyed and it is determined that species with viability concerns are not nesting.

Site preparation, cleaning and weeding treatments that remove saplings from forested stands should occur outside the songbird nesting season (April 1 to June 30).

The ANF is a partner in the North American Bird Conservation Initiative (NABCI) and in compliance with Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds.

Federally-listed threatened, endangered, and candidate species

A detailed analysis of potential effects to Federally-listed threatened, endangered, and candidate species is provided in Appendix E. The following is a brief summary of the effects on each species.

Indiana bat

Results of mist net surveys conducted on 311 sites throughout the ANF since 1998 have revealed that Indiana bat use may be limited to occasional summer visits by wondering males. With the capture of 3,092 bats over an eight year period, only one was an Indiana bat. No maternity roosts or winter hibernacula have been documented.

Forest Service activities that remove suitable roost trees may have a direct effect on Indiana bats. These activities include such things as commercial timber harvest, road and trail construction and pit development/expansion (Table 2-2). However, because Indiana bat habitat use is so minor, potential impacts of these activities is negligible and discountable.

Using canopy closure criteria identified by Romme *et al.* (1995), suitable, optimal, and less than suitable roosting and foraging habitat are presented for each alternative in Table 3-65. All alternatives provide at least 70 percent of Forest Service lands in optimal Indiana bat habitat.

Because Indiana bat use is so minor on the ANF and suitable and optimal habitat conditions are dominant on the landscape, a determination of “may effect, not likely to adversely affect” is made for all alternatives.

Table 3-65. Optimal, suitable and less than suitable habitat for the Indiana bat by alternative.

	Alt. A	Alt. B	Alt. Cm	Alt. D
Optimal (acres)	72%	72%	70%	75%
Suitable (acres)	8%	9%	11%	11%
Less than suitable (acres)	9%	9%	8%	4%

Bald eagle

The LRMP requires that suitable habitat be maintained for nesting, roosting, and foraging eagles and includes standards and guidelines to accomplish this. Because suitable habitat for nesting, roosting, and foraging would be maintained, and management activities near known nesting sites would be conducted in a manner that protects existing nest sites under all alternatives, the primary avenue of negative effects to bald eagles would be human disturbance associated with public use of the forest, particularly recreational use within primary bald eagle habitat.

On the ANF, the primary forms of disturbance include canoeing on major rivers, and boating and other forms of water based recreation on the Allegheny Reservoir. Although use can be high between Memorial Day and Labor Day, the heaviest activity is concentrated on the weekends. Recreational use along primary eagle nesting and foraging habitat has been taking place on the ANF for decades. The increase in bald eagle numbers over the past 10 years, indicate that if negative effects are occurring as a result of human disturbance, they are temporary and isolated. None of the alternatives propose management actions that would substantially increase water related recreation activity on the Allegheny Reservoir or major rivers and streams.

A “may effect, not likely to adversely affect” determination is made for the bald eagle under all alternatives.

Clubshell and northern riffleshell

Standards and guidelines to address potential runoff and sedimentation in the 13 percent of the ANF that drains directly into the Allegheny River will prevent potential adverse impacts to the clubshell or northern riffleshell from Forest Service activities under all alternatives. Monitoring has indicated that Forest Service activities are not contributing to the establishment of zebra mussels in the Allegheny River. Therefore, a “may effect, not likely to adversely affect” determination is reached for clubshell and northern riffleshell for all alternatives.

Small whorled pogonia

Suitable habitat for small whorled pogonias occurs across the ANF. However, none have been documented by extensive survey efforts. Standards and guidelines are included in the LRMP to ensure that these rare orchids are not adversely affected by herbicides or other management activities. A “no affect” determination is reached for the small whorled pogonia under all alternatives.

Northeastern bulrush

Suitable habitat for the northeastern bulrush occurs on the ANF. However none have been documented. Standards and guidelines are included in the LRMP to ensure that management activities, including herbicide application, do not adversely affect this species. A “no affect” determination is reached for the northeastern bulrush under all alternatives.

Candidate species- sheepsnose and rayed-bean

Found in the Allegheny River the effects to these two mussels are similar to those for the clubshell and northern riffleshell. Therefore, a “may effect, not likely to adversely affect” determination is made for the sheepsnose and rayed-bean for all alternatives.

Summary of direct and indirect effects

A summary of the direct and indirect effects to plants and animals as analyzed under each indicator by alternative is presented in Table 3-66.

Table 3-66. Summary of habitat indicators by alternative

Indicator	Alt. A	Alt. B	Alt. Cm	Alt. D
1. Habitat Structure				
Percent of NF lands (2060):				
Early Structural	14%	12%	10%	3%
Mid Structural	48%	49%	48%	51%
Late Structural	24%	25%	28%	39%
2. Habitat Composition				
Percent in oak type of NF land (2060)	12%	12%	13%	12%
Percent of NF with conifer component	10%	10%	10%	10%
Percent of NF in permanent openings	>2%	>2%	>2%	>2%
Miles of stream improvement	0	2	2	2
Annual Acres of Impoundment improvements	0*	32	32	32
Annual Acres of Riparian/wetland enhancement	85	93	101	38
3. Habitat Patterns				
Percent of NF lands managed for connectivity (MA 2.2)	0	19%	23%	25%
Percent of NF lands providing core or interior habitat (MA 5.1, 5.2, 7.2, 7.3, 8.2, 8.3, 8.5)	7%	8%	11%	15%
Percent of high quality remote habitat that would remain free of new roads and motorized trails (8 areas-33,000 acres)	63%	81%	88%	88%
Percent of quality remote habitat that would remain free of new roads and motorized trails (29 areas-28,200 acres)	35%	38%	60%	60%
4. Management Indicator Species				
Northern Goshawk – Percent of NF Suitable Nest Habitat (2060)	71%	72%	73%	83%
- Percent of NF Managed for predominately late structural landscape conditions	33%	30%	38%	71%
Cerulean Warbler – Percent of NF suitable oak/riverine habitat(2060)	12%	12%	13%	12%
- Percent of NF Suitable Nest Habitat (2060)	11%	11%	11%	12%
Timber Rattlesnake – percent of quality remote habitat that would remain free of new roads and motorized trails (29 areas-28,200 acres)	35%	38%	60%	60%
Aquatic Invertebrate Diversity – Miles of new road within 300 feet of stream 2060)	7.1	5.4	4.8	4.3
Mourning Warbler – Percent of Forest in Preferred Habitat (2060)	13%	12%	10%	4%
5. Game species				
Percent of NF lands in early structural habitat (2060)	14%	12%	10%	3%
Percent in oak type of NF land (2060)	14%	14%	14%	14%
Conifer, riparian/wetland/openings – see habitat composition above	22%	22%	22%	22%
6. Species with Viability Concerns				
Number of species with improved viability outcome risk from present condition (2060)	0	0	0	0
Number of species with worse viability outcome risk than present condition (2060) (drop from outcome B to outcome C) as a result of FS actions	1	1	1	0

* acres determined with site-specific analysis

Cumulative effects

The cumulative habitat effects include effects from past, present, and future foreseeable actions from activities on Federal and non-Federal lands. The affected area for cumulative effects on animal and plant habitats varies by section. In general the four-county area is used to assess cumulative effects for habitat structure and composition, while the proclamation area is used for other elements. The cumulative effects area depends largely on the availability of data at larger scales. Time frames used in the cumulative effects analysis are 2020 to address short-term effects and 2060 to address long-term effects.

Some of the non-Federal actions and events that contribute to cumulative effects include:

1. Development of private oil and gas reserves including construction of roads and well pads and installation of pipelines and tank batteries.
2. Spread of non-native zebra mussels throughout the Allegheny River system from Conewango Creek and the Allegheny River in New York.
3. Spread of non-native plant species from private lands onto Forest Service lands.
4. Spread of hemlock woolly adelgid from nearby infested areas.
5. Decrease in the quality of oak habitat on private lands due to the lack of investment in burning, fencing and other intensive reforestation practices necessary to regenerate oak.

Habitat indicator 1 – Structural class diversity

Much of the data for cumulative effects to plant and animal habitats is extrapolated from vegetation information provided in the vegetation management cumulative effects section. The four county area contains more than 1.7 million acres of forested land of which 29 percent is National Forest, 14 percent is other public land (primarily State Game lands and State Forest lands), 3 percent is private industrial forest, and 54 percent is private non-industrial forest.

By 2060 early structural habitat will comprise 14 percent, 12 percent, 10 percent, and 3 percent of National Forest land for Alternatives A through D, respectively (Table 3-50). By 2060 late structural habitat will comprise 24 percent of the total National Forest lands under Alternative A, 25 percent under Alternative B, 28 percent under Alternative Cm and 39 percent under Alternative D (Table 3-50). For all alternatives this is a substantial increase over the present condition of 4 percent late structural forest.

Nowak (1997) estimated that for all ownerships across all of Pennsylvania that 26 percent of forest land would be late structural (200+ years), and 24 percent would receive cuts that remove 80 percent or more of the basal area (even-age third and fourth growth forest) by the year 2100.

Based on these data some general conclusions can be drawn about the habitat structure of forest lands in the four-county area by 2060:

- Early structural habitat will increase from the current level of about 7 percent to somewhere in the range of 10 percent to 17 percent for Alternatives A, B, and Cm. For Alternative D the range may be about 3 to 5 percent.

- Late structural habitat will increase from the current level of about 4 percent to somewhere in the range of 25 percent to 40 percent for all alternatives.
- These cumulative increases in both early and late structural habitat for all alternatives except D would result in a more even distribution of structural habitat stages. Some of the current large acreage in the mid structural stage would shift to both early and late structural stages. No cumulative effect to animals and plants is anticipated due to these shifts in structure under Alternatives A, B, and C.
- Under Alternative D the amount of early structural habitat would actually decrease from current levels. This decrease would likely cause a decrease in distribution and abundance of some species that utilize early structural habitat.

Habitat indicator 2 – Amount and trends in habitat composition

Oak forest

Management of oak on non-industrial private land is critical to ensuring that oak is sustained across the landscape. Because non-industrial private lands will likely not receive the intensive reforestation necessary to regenerate oak (i.e., prescribed fire, fencing, soil scarification) many oak stands will regenerate to red maple or other hardwoods. Since oak forests provide acorn mast for a variety of wildlife, a decline in habitat quality in oak forests on a portion of the private non-industrial forest land is expected over the long term. This decline in habitat quality increases the importance of sustaining healthy oak forests on public forests and private industrial forests in the four-county area.

Conifer forest

The major threat to conifer forests in the four-county area is the loss of hemlock due to the predicted infestation of the hemlock woolly adelgid. The cumulative impact of the loss of about 50 percent of the hemlock by 2060 would adversely affect several species with viability concerns (addressed later in this section) as well as thermal cover for deer and turkeys.

American Beech Component

Beech is a component of much of the hardwood forest in the four-county area. Beech bark disease has infected a large portion of the landscape killing a large percentage of the mature beech trees on all ownerships. Although some beech trees are resistant, a large portion die and fall over, reducing their value as den trees for wildlife and eliminating their ability to provide beech mast, an important food source for game and non-game species. The large beech trees are often replaced by beech root suckers which develop into dense stands of beech saplings and poles before becoming infected with beech bark disease again. Similar to the situation with oak, the result for the four-county area, is the loss of an important food source and loss of large den trees resulting in a decline in habitat quality across the landscape.

Rivers, streams, impoundments**Vegetation management**

Logging on private land is expected to continue in the long-term. Private operations are encouraged to implement state Best Management Practices (BMPs) to prevent or minimize sediment to streams, such as establishing buffer strips along streams. Often, BMPs are used because the operator is responsible for not violating the PA Clean Streams Law. So long as private landowners and logging operators implement BMPs, there should not be any cumulative effects from vegetation management to aquatic species or their habitat.

The possible infestation by the hemlock woolly adelgid to trees along streams has the potential in the short- and long-term to affect stream shading. With enough defoliation and where hemlocks are prevalent, stream sections have the potential to warm beyond the level suitable for the survival of brook trout and other cold-water species. This affect has the most potential where streamside vegetation is dominated by hemlock, both on private and ANF lands. In a lot of instances, streams are fed by springs or groundwater and can temper warming of water caused by lack of streamside shade. At this point, it is uncertain what the full effect of this would be to cold-water stream fish and other aquatic species.

Road construction and management

Many of the roads within the proclamation boundary have been in place since the early logging era (late 1800s-early 1900s). Over the years, the number of roads have increased, some which are poorly located, have drainage problems, or lack properly sized culverts. As such, roads have contributed to changes in drainage patterns, increased sediment load, and fish passage problems.

Many of these private dirt and gravel roads are used for oil and gas management activities. These roads receive a lot of daily use and thus tend to generate a large amount of fine sediment from the breakdown of sandstone surfacing. This can accelerate the amount of fine material deposited in streams and affect aquatic habitat. Under all alternatives, the projections are for additional dirt and gravel roads to be constructed to access new oil and gas wells being drilled. The location of these roads will determine what potential affects they would have on aquatics. Based on recent trends, there is a high potential for roads to be built near streams where they will eventually become hydrologically connected. This connection would provide a direct avenue for sediment to enter streams, thus becoming a long-term source.

When taking Forest Service road activity into consideration, the cumulative effects would be highest in Alternative A, with the lowest potential effects for Alternative D. The potential for effects to occur will be highest where a higher density of roads are built to access privately owned wells and are close to streams. However, it is not known where this will specifically occur during the planning period. Where roads are located close enough to streams to potentially effect them, Forest Plan standards and guidelines and/or site-specific mitigation measures are expected to be implemented by private oil and gas developers. As a result of implementing these protective measures, cumulative effects are expected to be minimized. However, where roads close to

streams become numerous, the protective measures may not be able to prevent adverse effects to aquatic species from occurring.

Motorized ATV/OHM Trails

In addition to roads, motorized trails have increased significantly in the past several years. Private lands throughout Pennsylvania, both within and outside the ANF proclamation boundary, have seen large increases in recreational off-highway vehicle use (Lord *et al.* 2004). These private trails, which are usually not maintained and sometimes located in sensitive areas, can impact aquatic systems on the ANF.

Off-highway riding is expected to continue in the short- and long-term. As long as trails on private lands continue to be developed, there is a likely chance of sediment reaching streams on the ANF which can affect aquatic species and their habitat. The amount of private trails is unknown, but it would be the same under all Alternatives since this is an activity not controlled by the Forest Service.

The potential cumulative effects, when Forest Service designated acres for trail development are taken into account, are highest for Alternative B (approx. 113,000 acres of Forest Service land). This is followed by Alternatives A and Cm that have approx. 99,000 and 83,000 acres respectively. Alternative D provides the least potential for cumulative effects based on the lowest amount of acreage available for trail development on Forest Service lands (approx. 40,500 acres).

Oil and gas management (private)

The potential for cumulative effects to occur to fish and other aquatic species and their habitats are similar for all Alternatives. The current level of activity associated with development of new private wells is expected to continue, at least in the short-term. As prices for oil and gas rise or fall, so normally does new activity such as drilling and road building. The potential for spills to occur and reach streams becomes higher the more wells are drilled. Under the current level of activity, this potential is high.

Invasive species

Several aquatic invasive species are present in waters within northwest Pennsylvania and southwestern New York in close proximity to the ANF. Some of these waters are connected to the Allegheny River which is occupied by a number of sensitive mussel and fish species, as well as the two federally endangered mussels and two federal candidate mussels. Currently, the biggest threat to species in the river is from zebra mussels.

In 2005, zebra mussels were documented for the first time in the Upper Allegheny River, occurring at Warren and in New York upstream of the Allegheny Reservoir. This occurrence presents a high likelihood that habitat for these species will be affected. For the native mussels, it's not only the habitat that would be affected, but zebra mussels can directly impact individuals to the point where they are killed. This is normally caused by zebra mussels that colonize on a mussel and literally smother it or cause it not to be able to feed. There is some uncertainty as to

what level the affect would be to the native mussels, as it depends on how well the zebra mussels can adapt, survive, and proliferate in the river.

For the sensitive fish species in the Allegheny River, it is the habitat that is most likely to be affected. Many of these fish species prefer the flowing water of riffles, but also inhabit slower, deeper water in the winter months. These slower, deeper areas are locations where the fish's habitat could be most affected. However, like the mussels, there is some uncertainty on what the level of affect would be.

Because the affect that is likely to occur is not under Forest Service control and is a result of zebra mussels coming from waters not on the ANF, the cumulative effects for each alternative would be the same.

Acidic waters

The water resource section discusses the potential effects to waters on the ANF from acid deposition. The Soils section also discusses the loss of base cations from ANF soils as a result of acid deposition. These affects can impact fish and other aquatic species that inhabit headwater streams when pH levels become too low, or acidic. There are currently several streams on the ANF that either cannot support fish or in very limited numbers due to this condition.

Under all alternatives, acid deposition is something not under the control of the ANF. Thus, the cumulative effects are the same for all alternatives. The short- and long-term cumulative effects are that acid deposition will continue to affect waters that are otherwise suitable for habitation of numerous aquatic species.

Herbicide

The cumulative effect of herbicide treatments would be enhancement of understory structure and composition. Very little herbicide treatment is likely to occur on private non-industrial lands so monocultures of fern and striped maple and beech understories would persist on private non-industrial lands. State Game lands, State Forest lands, and some industrial forest lands would continue to use herbicides. Forest cover would be sustained.

In Alternatives B, Cm, and D, non native invasive species would be controlled in many areas of the ANF using herbicides. On private lands invasive species would likely continue to spread, possibly encroaching on National Forest lands. Without invasive plant control on private land using herbicides, cumulative impacts to habitat quality will increase in the long term.

Habitat indicator 3 – Changes in habitat patterns on the landscape

Cumulative effects to landscape patterns are assessed for the area within the National Forest proclamation boundary.

Remote habitats

Of the eight high quality remote habitats on the ANF, Morrison Run appears to have the highest likelihood of being extensively roaded by oil and gas development and thus diminishing the quality of remote habitat. Although there has been some interest expressed in mineral development in some of the other high quality remote habitat areas, most of these areas are outside of the currently known oil and gas fields and the likelihood of mineral development is uncertain. However, with an anticipated range of between 3,375 and 12,000 new wells and 850 to 3,000 miles of additional oil and gas roads on the ANF by the year 2020 some mineral development at least on the periphery of these remote habitat areas (except for Hickory Creek) is expected (Appendix F).

Under Alternative A the percent of the high quality remote habitat (8 areas totaling 33,000 acres) that would remain unroaded (including oil and gas roads) would be about 63 percent. Morrison Run would remain in MA 6.2 and would become roaded when timber harvest begins, so mineral development would have little impact on its remote habitat quality.

Under Alternative B the cumulative effect of oil and gas development in Morrison Run and the creation of an Intensive Use Area for ATV/OHMs in Chestnut Ridge (Indian Run) would reduce the percent of high quality habitat to about 70 percent of the current 33,000 acres. The cumulative effect of oil and gas development to high quality remote habitat under both alternatives Cm and D would be a reduction to about 88 percent of the current 33,000 acres.

Large private lands or State Game Lands within the proclamation boundary are well roaded and although they may provide some remote habitat, it is not near the quality of the remote habitat in the eight areas described above (USDA FS 2003b). Therefore, other non-Forest Service lands within the proclamation boundary would not contribute high quality remote habitat, and activities on non-Forest Service lands would not create adverse cumulative impacts to high quality remote habitat.

Only about 1 or 2 percent of the 29 areas (28,200 acres) of quality remote habitat are within known oil and gas fields. New roads and well pads are anticipated in about 5 to 20 percent of this quality remote habitat during the planning period.

Core areas and habitat connectivity

Roads and well pads are spread through the known existing oil and gas fields on the ANF. A large portion of the expected increase in wells and roads will occur within these known fields, but expansion beyond known fields is also expected. The quality of late structural habitat and the connectivity of the landscape decreases as the amount and density of roads and well pads increases. Impacts to wildlife depend largely on the vagility of the species and tolerance of human disturbance.

Table 3-67. Miles of new road and motorized (ATV/OHM) trail on Forest Service lands during the planning period by alternative.

	Alt. A	Alt. B	Alt. Cm	Alt. D
New Forest Service Roads (miles)	116	103	85	69
New motorized (ATV/OHM) trails (miles)	73	124	45	12
New Oil and Gas roads (miles)	1,922	1,922	1,922	1,922
Total miles of new road and motorized trail	2111	2149	2052	2003

Table 3-68. Percent of connected and core habitat within known oil and gas fields

(Percentages are percent of ANF connected habitat or percent of core habitat (from Table 3-55) that contain known oil and gas fields)

	Alternative A	Alternative B	Alternative Cm	Alternative D
Percent of area managed for connectivity within known oil and gas fields (MA 2.2)	0*	30	36	37
Percent of area managed as core areas within known oil and gas fields (MA. 5.0 7.2, 7.3, 8.2, 8.3, 8.5)**	5	8	6	9

* 36,800 acres of MA 6.1 are within known oil and gas fields (29%)

** Hickory Creek Wilderness and Tionesta RNA acreage is not included because the minerals have been withdrawn from leasing.

The cumulative impact of new Forest Service roads, new motorized trails, and new oil and gas roads to the whole forest matrix underscores the need for core areas and habitat connectivity where road densities are lower and human activities are less disruptive to wildlife. These cumulative totals are displayed in Table 3-67.

The acreage of connected habitat and the acreage of core areas by alternative was previously provided in Table 3-55.

The acreage of connected habitats and core areas within known oil and gas fields under each alternative is provided in Table 3-68. These data indicate that oil and gas activity is likely to occur in less than 10 percent of the core areas and about one third of the connected habitat. As the acreage of habitat managed for connectivity increases by alternative, the percent of that acreage in known oil and gas fields also increases. However, as the linkages between core areas become wider and more numerous, going from Alternative B to D, the risk that habitat connectivity will be compromised due to increased roads and oil and gas activity becomes less.

Oil and gas development on National Forest lands is expected to reach about 16,000 wells, 3,100 miles of roads, with about 10,000 acres of disturbance by 2020 (Appendix F). The total miles of Forest Service road will vary between 1,630 and 1,880 miles by the sixth decade (Table 3-16). Total miles of motorized trails will vary between 80 and 230 miles. Under this intensity of disturbance, core areas that are linked

with relatively contiguous forest are essential for maintaining well distributed populations of less vagile species or species that are sensitive to human disturbances. The risk of isolating populations and reducing the resiliency of populations is reduced as the number of linkages and width of the linkages increases going from Alternative A to D.

Habitat indicator 4 – Amount and trends in habitat for management indicator species

Northern goshawk

Cumulative effects will be evaluated by looking at activities that could result in habitat modification or disturbance that affects viability of the northern goshawk on the ANF. Effects evaluated include timber harvest, summer motorized trail construction and forest health concerns that could potentially result in unsuitable or marginally suitable goshawk habitat, as well as oil and gas development, which can create unsuitable nesting conditions. One of the primary reasons the ANF provides high quality goshawk habitat is its predominately mature forested character and the presence of large blocks of relatively undisturbed forest. Because adjacent watersheds within the four-county area that makes up ANF contain less mature forest and significantly greater levels of forest fragmentation and disturbance, they provide less desirable goshawk habitat. As a result lands within the proclamation boundary better reflect anticipated impacts to the high quality goshawk habitat that makes up the ANF and the cumulative effects analysis area includes all private and National Forest within the proclamation boundary.

Because even-age partial harvest and uneven-aged management maintains or improves goshawk habitat, evaluation of timber harvest will focus on the amount of even-age final harvest that would be expected to occur during the analysis period. The starting point of the analysis period is 1975, as this is the year of origin of regenerated stands that presently do not provide suitable nest habitat. Whereas 2060 was chosen as the end of the analysis period, as this is the period of time when proposed final harvest activities have generally begun to level off.

Effects common to all alternatives

The forest is being affected by a variety of insect and disease related impacts and changes currently taking place as a result of introduced insects and mortality/decline is expected to continue. The rate of change will be set by the interaction of natural forces such as additional drought, insect defoliations or windstorms, or human caused forces such as introduced insects and diseases or atmospheric deposition. Because of the goshawks preference for conifer, it is particularly susceptible to the hemlock woolly adelgid (HWA). It is anticipated that the HWA will be on the ANF within 3-5 years and although the ANF will continue to work with Forest Health Protection (FS State and Private Forestry) to monitor the conditions on the ANF, it is anticipated that by 2060, up to 50 percent of the hemlock on the Forest could be lost due to the HWA. Because the goshawk prefers conifer at both the site and landscape scale, this reduction in conifer would be expected to have long-term ecological impacts to the northern goshawk.

Oil and gas development is assumed to be constant across all alternatives. Approximately 93 percent of minerals underneath the ANF are privately owned and development is expected to continue on private and National Forest. It is estimated that 10,400 wells have been developed to

date within the analysis area. This development has resulted in the conversion of approximately 13,500 acres of forest to non-forest and is a direct loss of suitable nesting habitat. In addition to the direct loss of habitat due to forest conversion, Forest monitoring shows that intense oil and gas development can result in unsuitable goshawk habitat and it is estimated that currently 100,000 acres or 14 percent of the analysis area has been affected by this type of intense development (well spacing of 660 ft. or less).

Based on future development, by 2060 it is anticipated that new well development could result in the conversion of approximately 38,000 acres of forest to non-forest within the proclamation boundary. Additionally, it is anticipated that almost 250,000 acres, or 33 percent, of the analysis area will have been made unsuitable for the northern goshawk due to intense oil and gas development. In addition to the total loss of habitat, potential effects to known nesting territories were evaluated and based on the location of known oil and gas pools, it is anticipated that 18 of the known goshawk territories (42%) and 3 (25%) of the currently active territories will be made unsuitable due to this increased level of development; whereas 10 known territories and 3 currently active territories are considered to be at risk, depending on where the actual development occurs. While there may be some oil and gas development, because of the distance to known oil and gas pools, it is anticipated that 15 (35%) known territories and 6 (50%) currently active territories will maintain suitable habitat conditions.

Even-age final harvest on private land is assumed to remain at current levels and for the purpose of this analysis it is estimated that this treatment will be completed on 8 percent of non-forest service land/decade.

Effects by alternative

Effects that vary by alternative include even-age final harvest and motorized trail construction. Table 3-69 displays these effects and summarizes all anticipated cumulative effects by alternative. The area affected by motorized trail construction was calculated by multiplying the total miles of trail proposed by 660 feet. and assumes that habitat suitability will be reduced for 330 feet. of both sides of the trail. In order to provide a point of reference, Table 3-69 also displays effects during the year 2005.

Table 3-69 summarizes cumulative effects by alternative and displays anticipated impacts to goshawk nesting and foraging habitat. Because some of the final harvest activities will occur within areas of intense oil and gas development, the amount of land within each category cannot be used to calculate a cumulative total of the amount of habitat affected. However, the information presented in Table 3-69 provides a relative index as to the amount of land that will be affected under each of the activities. Due largely to the intense oil and gas development that is expected to occur, by the sixth decade it is estimated that between 40 and 50 percent of the analysis area could be made unsuitable for goshawk nesting under the proposed alternative, while foraging habitat would be reduced by 33 percent under all alternatives.

Table 3-69. Northern goshawk cumulative effect summary

			2060			
Activity	Resulting Habitat Condition	2005	A	B	Cm	D
Intense Oil and Gas	Unsuitable Nest and Foraging Habitat	14%	33%	33%	33%	33%
Motorized Trail	Reduced Nest Suitability/ Productivity	1.2%	1.7%	2.8%	1.7%	1.3%
NF Final Harvest	Unsuitable Nest, Suitable Foraging	8.9%	18.8%	17.5%	14.8%	4.9%
Pvt. Final Harvest	Unsuitable Nest Habitat, Suitable Foraging	8.0%	8.0%	8.0%	8.0%	8.0%

¹It is estimated that approximately half of this disturbance will occur within areas of intense oil and gas development.

Anticipated cumulative effects may create large blocks of unsuitable nesting and foraging habitat and reduce the viability outcome for the northern goshawk. However, based on the analysis presented and the following rationale, all alternatives are expected to provide adequate habitat to maintain viable populations of this species:

- Implementation of ANF nest protection guidelines are expected to reduce potential effects on active nests from FS as well as private oil and gas activities
- Between 50 and 60 percent of the ANF will continue to provide suitable habitat preferred by the northern goshawk
- Large blocks of remote, relatively undisturbed forest will continue to be available across much of the ANF

Cerulean warbler

Cumulative effects will be evaluated by looking at activities such as even-age final harvest and oil and gas development, which can create unsuitable cerulean warbler habitat or result in a loss of forest cover.

Because suitable riverine/riparian habitat will be protected under all alternatives, and since it is not possible to accurately separate out oak and oak transition forest on private and State lands, the cumulative effects analysis will evaluate the above effects on both primary (oak and oak transition forest) and secondary (hardwood stands with an oak component) habitat. In order to identify potential habitat, all seventh order watersheds that contain an oak component and riverine habitat were identified as the cumulative effects analysis area boundary. This area totals 332,429 acres, 65 percent of which consists of National Forest System land. Although there is a well established cerulean warbler population in Allegany State Park (ASP) immediately north of the ANF, the ASP was not included in the cumulative effects area because it receives little active management and including this acreage in the analysis would tend to “dilute” potential effects. The year 1956 was chosen as the starting point of the analysis period, as this would be the last year of origin for stands that are still considered unsuitable cerulean warbler nest habitat (i.e., forest < 50 yrs. of age). 2060 was chosen as the end of the analysis period, as levels of oak regeneration will stabilize by this time.

Effects common to all alternatives

Although it is difficult to predict the degree of impact from forest health and insect and disease, it is anticipated that existing forest health concerns that threaten oak and oak transition stands will continue.

Oil and gas development is assumed to be constant across all alternatives. Approximately 93 percent of minerals underneath the ANF are privately owned and development is expected to continue on private and National Forest. Assuming an oil well saturation rate similar to what is anticipated on NFS lands, it is expected that approximately 13,000 wells could be developed within the analysis area by 2060 and that this development will result in the conversion of approximately 17,000 acres of forest to non-forest. As a result it is anticipated that by 2060, oil and gas development will result in loss of approximately 5 percent of the suitable forest habitat within the analysis area under all alternatives.

Even-aged final harvest within suitable habitat on private land will create unsuitable cerulean warbler nesting habitat for 50 years and it is estimated that this treatment will be completed on 5 percent of State/private lands/decade within the analysis area. The even-age final harvest figure in Table 3-70 includes all even age final harvest activities on State/private as well as National Forest.

Effects by alternative

Table 3-70 displays the amount of suitable habitat that will be expected to occur within the analysis area under each of the alternatives and it is anticipated that by 2060, suitable cerulean warbler habitat under Alternative B will be reduced on approximately 79,000 acres, or 24 percent of the analysis area. Suitable habitat will be reduced by approximately 21 percent, 22 percent and 16 percent under Alternatives A, Cm and D respectively.

Table 3-70. Cerulean warbler cumulative effects summary.

	2060 ¹			
Activity	A	B	Cm	D
Non-Forest (%)	7.0	7.0	7.0	7.0
Even age Final Harvest (%)	13.6	16.7	15.4	9.0
Total Unsuitable Habitat (%)	20.6	23.7	22.4	16.0
Total Available Habitat (%)	79.4	76.3	77.6	84.0

¹ - Expressed as a percent of the analysis area

Summary

While suitable cerulean warbler habitat will be reduced by up to 24 percent of the analysis area, considering 1) that suitable habitat will continue to occur on 76 percent or more of the analysis area and that remaining habitat will be well distributed across the landscape, 2) that suitable core forest habitat and lands managed for connectivity within the analysis area will remain intact, 3) that little habitat modification will occur in preferred riverine habitat along the Allegheny and Clarion rivers, 4) that lands made unsuitable will be widely scattered and not create large blocks of unsuitable habitat and 5) that effects of fragmentation will be reduced somewhat due to the extensively forested nature of the area, there is not expected to be a reduction in viability for this species under any alternative.

Timber rattlesnake

Cumulative effects will be evaluated by looking at activities that could result in habitat modification or disturbance that affects viability of the northern timber rattlesnake on the ANF. Due to the relatively small home range required by this species, the cumulative effects analysis focuses on all lands within the proclamation boundary and includes actions of other agencies and private landowners. One of the primary reasons the ANF provides high quality rattlesnake habitat is its predominately mature forest, large blocks of relatively undisturbed forest and integrated resource management. Adjacent watersheds within the four county area that makes up the ANF contain less mature forest, more development and significantly greater levels of forest fragmentation and disturbance.

The extensive logging and railroads that occurred in the early 1900s likely eliminated habitat for this species as well as individual populations. Individual accounts from people who witnessed and worked on the construction of the Kinzua Dam, state that hundreds of timber rattlesnakes were encountered during the construction of the dam and that workers would kill them or throw them into large steel tanks where they would die. Therefore the habitat as well as populations is considered reduced from historical levels.

The Pennsylvania Fish and Boat Commission has begun a study on the timber rattlesnake population through a State Wildlife Grant obtained from the U.S. Fish and Wildlife Service. The first aspect of the study concerns assessment and inventory of historic rattlesnake sites. In the spring of 2003, six teams of experienced rattlesnake surveyors started confirming and classifying historic rattlesnake sites as dens, rookeries or basking areas. The study will ultimately provide vital information on the relative population health and status of the timber rattlesnake in Pennsylvania (Urban 2005). In addition, a proposal has been made to increase the cost for a collection permit that allows hunters to collect one snake per season, to limit the collection to snakes over 42 inches long and to collect only males. These changes are expected to be in affect in 2007.

Effects common to all alternatives

Oil and gas development is assumed to be constant across all alternatives and based on past, present, and anticipated future development, it is anticipated that five percent of the analysis area will be made unsuitable due to the conversion of forest to non-forest habitat. Similarly, even-age regeneration harvest on private and State lands is expected to remain constant and that by 2060, it

is expected that preferred early structural habitat will occur on approximately 8 percent of these lands under all alternatives.

Development of private mineral rights in suitable timber rattlesnake habitat could adversely affect the timber rattlesnake populations by increasing the amount of human/snake encounters, therefore increasing the possibility of mortality from vehicles or poaching. In addition, the permanent loss of forest habitat and the increase of oil well complexes would cause fragmentation, possibly to the extent of creating barriers, reducing gene flow and eventually extirpating populations. Assuming 6,600 acres of land will be converted to oil and gas development per decade for the first four decades, 26,400 acres of forested land will be converted by 2046. This level of activity will have an adverse effect to species that are sensitive to disturbance and species that are less mobile and restricted by barriers such as roads and openings. This activity will have a substantial impact on the timber rattlesnake, specifically their ability to migrate and mate.

The rate of change in vegetation will be set by the interaction of natural forces such as drought, insect defoliations, windstorms, or human-caused forces such as introduced insects and diseases or atmospheric deposition. As beech scale complex continues to spread within the ANF, individual beech and northern hardwood stands with concentrated pockets of beech will be affected by mortality of larger beech trees and subsequent root sprouting of beech. If the hemlock woolly adelgid impacts hemlock trees and mortality occurs on the ANF, hemlocks will be replaced with deciduous species such as red maple and birch if there is no intervention. A loss of these two tree species surrounding a rattlesnake den could be beneficial by creating more openings for basking, especially for gravid females. The mortality of these tree species across the landscape would provide more down woody debris thus providing more foraging areas for the timber rattlesnake by creating more horizontal structure to ambush its prey. Conversely, if there is a widespread loss of beech, there would be a decrease in mast crop, which could reduce the number of small mammals (prey) that an area could support. The timber rattlesnake is not specifically dependent on beech or hemlock forests to complete their life processes so it will not be adversely affected by any level of mortality.

Effects by alternative

While all alternatives maintain adequate amounts of forested habitat that could be utilized by timber rattlesnakes, they each vary in terms of the quality and quantity of this habitat. Over the long term, some habitat features that are utilized by the timber rattlesnake will be more abundant depending on the chosen alternative. Because Alternative D emphasizes forest conditions that are dominated by mid to late structural conditions and reduced levels of disturbance, approximately 80 percent of the forested landscape will be maintained to provide conditions suitable to support timber rattlesnake. Alternative D will provide the overall highest quantity of preferred habitat for this species (Table 3-71).

Table 3-71. Habitat considerations for timber rattlesnake, by alternative.

Habitat Considerations	Current	Alt. A		Alt. B		Alt. Cm		Alt. D	
		2020	2060	2020	2060	2020	2060	2020	2060
Early structural habitat (percent of NF land)	7%	9%	14%	9%	12%	8%	10%	4%	3%
Late structural habitat (percent of NF land)	4%	8%	24%	10%	25%	10%	28%	9%	39%
Connectivity (percent of NF land in MA 2.2)	0%	0%		19%		23%		25%	
Core areas (percent of NF lands in MA 5.1, 5.2, 7.2, 7.3, 8.2, 8.3, 8.5)	7%	7%		8%		11%		15%	
High quality remote habitat (percent of 33,000 acres with restricted roads and motorized trails)	63%	63%		81%		88%		88%	
IUAs (thousands of acres)	98.9	98.9		113		83.2		40.5	
Horseback Riding (thousands of acres):									
• EUAs	0	0		10.5		10.5		49.9	
• open riding	506	506		470		457		0	
Roads (total miles of new FS roads)	1269	116	344	103	214	80	168	69	152
Prescribed fire (acres – average annual amount)	3.6	280		650		564		358	

It is well-known that timber rattlesnakes use ancestral/communal den sites for hibernating. Dens are a central focus in the life history and ecology of timber rattlesnakes. Free-ranging and dispersing adult males can move several miles from a den. However, the majority of the individual timber rattlesnakes, including neonates, gravid females and subadults, which are found at a given den site, spend much of their time in these areas basking, feeding, mating and giving birth within several hundred yards of the den site. Therefore, protecting these dens and the surrounding habitat is crucial to rattlesnake conservation. All efforts should be made to protect this feature on the ANF lands. Known den sites are protected and monitored on State Game Lands.

Determination of effects and rationale

The permanent loss of forest habitat occurring from projected timber harvest, recreation or wildlife habitat management would be minimal, and the majority would be short-term in nature. All Alternatives provide areas of mature and late structural forest, unroaded areas, core forested areas and connectivity. Alternative D would designate the most (25%) landscape linkage (MA 2.2) with and additional 5 percent managed for late structural habitat (MA 6.1). In addition, 88

percent of interior and remote habitat will be retained under Alternatives Cm and D. A large threat to timber rattlesnake populations and viability is mortality from human/snake encounters and fragmentation. The ANF will continue to educate the public about the benefits of sustaining populations of rattlesnakes and to increase awareness of the laws protecting this species. Monitoring will continue on the ANF and a memorandum of understanding is being developed to assist the Fish and Boat Commission with their population study.

The biggest cumulative adverse effect could occur from private oil and gas development which would lead to habitat destruction, fragmentation and the reduction of gene flow.

Since dens are a central focus in the life history and ecology of timber rattlesnakes, all efforts made to document and avoid these sites will increase the probability of sustaining viable populations of timber rattlesnakes. Implementing the standards and guidelines in the LRMP will also protect potential habitat and help to protect this species.

Impacts to timber rattlesnake habitat on other agency lands within the proclamation boundary are believed to be comparable to National Forest lands. Standards similar to those implemented on the National Forest lands are likely to be implemented on State Game Lands. Sightings of individuals have been documented within the cumulative effects analysis area and known and prospective dens have been monitored on National Forest Lands. Mitigation measures will continue to be used to minimize potential impacts to this species as a result of activities implemented by the National Forest.

Management activities occur at varying levels on privately owned lands. Some areas are retained as mature forests while others have been and will be harvested. The level of conservation of this species on private lands is unknown as well as the number of viable den sites. The most common reaction to timber rattlesnakes by the public is to kill them which makes the National Forests conservation approach all the more imperative to protect and perpetuate this species.

Aquatic invertebrates

Effects by activity

Vegetation management

Two things outside the control of the Forest Service that have the potential to affect aquatic insect communities on the ANF are logging on private lands and the likely infestation by several invasive species. Invasive species that are likely to affect the forest are the hemlock woolly adelgid, emerald ash borer, and the current occurrence of beech bark disease.

Logging will continue to occur on private lands in areas that drain to the ANF lands. There is a potential for the removal of shade trees along streams and runoff to occur. Loggers are however encouraged to implement BMPs to prevent or minimize sediment from reaching streams, to prevent the warming of cold-water streams, and maintain the integrity of streams. So long as

private landowners and logging operators implement these BMPs and any site-specific mitigation measures, cumulative impacts to aquatic insects should not occur in any alternative.

The likely infestation of the hemlock woolly adelgid has the potential to affect stream-side shading where hemlock is the dominant species. This could cause a shift in the aquatic insect community as the canopy opens up more. Openings created along streams can actually create a more productive stream environment, but having too much can create undesirable conditions for other aquatic species. A similar concern is with the emerald ash borer, but in both cases, it is uncertain what the full effect of these infestations will be on the aquatic insect communities.

Road construction and management

The potential effects from non-ANF roads are the same in all alternatives since these actions are outside the control of the ANF. When ANF roads are taken into account, Alternative A has the highest potential for effects to occur, with the lowest being Alternative D. There are hundreds of miles of non-ANF roads within the proclamation boundary, many which are used in the oil and gas fields. Many of these roads are generally not constructed or maintained to the standard of the ANF, and some are located in close proximity to streams.

Similar to the effects discussed for Rivers, Streams, and Impoundments, it is anticipated that additional dirt and gravel roads will be constructed to access new privately-owned oil and gas wells being drilled. The location of these roads will determine what potential effects they could have on aquatic insects. Many of the existing, and future roads, are used extensively, most receiving daily use which generates a large amount of fine sediment from the breakdown of sandstone surfacing and that is easily transportable to streams. Based on recent trends, there is a high potential for dirt and gravel roads to be built near streams where they are likely to become hydrologically connected and thus transport sediments directly to a stream.

With an increase in sediment input, there is an expected decrease in the amount of available habitat. Aquatic invertebrate diversity and/or relative abundance could be reduced during the construction of a road, and for at least a short period thereafter where roads contribute runoff to a stream. Longer term effects will depend on the surfacing used, how much runoff is going to a stream, and how well private dirt and gravel roads are properly maintained. Typically, sandstone surfacing, which is more prone to breaking down and producing more fines that can more easily reach a stream, is used on private dirt and gravel roads, including roads for oil and gas. These same roads are generally not as well maintained based on past experience. Where rutting is allowed to occur, and fine sediment accumulates on a road, can result in longer-term reductions in aquatic invertebrate diversity and/or relative abundance.

Where roads are located close enough to streams to potentially effect them, Forest Plan standards and guidelines and/or site-specific mitigation measures are expected to be implemented by private oil and gas developers. As a result of implementing these protective measures, cumulative effects are expected to be minimized. However, where roads close to streams become numerous, the protective measures may not be able to prevent adverse effects to aquatic invertebrates from occurring.

Motorized ATV/OHM Trails

Similar to the Rivers, Streams, and Impoundments effects discussion, the cumulative effects are highest for Alternative B when ANF proposed actions are taken into consideration. Alternative D would have the least potential effects. Coupled with the heavy use on private lands within the proclamation boundary, Alternative B provides the highest number of acreage available for the development and use of these trails. The amount of private trails is unknown, but it would be the same under all alternatives since this is an activity not controlled by the ANF.

Sediment is the primary concern from these trails. Poor location and inadequate maintenance of private trails can lead to accelerated runoff into streams. Where existing and new trails will contribute runoff to a stream from private activities, aquatic invertebrate populations could have reduced diversity and/or relative abundance depending on site conditions, the amount of trail use, and the level of maintenance.

Oil and gas management

The potential for cumulative effects to occur to aquatic insects and their habitats are the same for all Alternatives. The current level of activity associated with development of new private wells is expected to continue, at least in the short-term. As prices for oil and gas rise or fall, so normally does new activity such as drilling and road building. The potential for spills to occur and reach streams becomes higher the more wells are drilled. Under the current level of activity, this potential is high. If a spill were to occur, local populations could be immediately affected with a reduction in diversity and/or relative abundance. Typically, if this were to occur, the impacts are generally short-lived and depending on the severity of a spill, the population can generally re-colonize within a few years.

Mourning warbler

Potential cumulative effects to the mourning warbler will be evaluated by looking at the amount of non-forest or unsuitable mourning warbler habitat, as well as by looking at the amount of suitable habitat that will be created under each of the alternatives. Effects evaluated include timber harvest treatments that create preferred early and multi-structural habitat conditions and by looking at activities that convert forest to non-forest and result in unsuitable mourning warbler habitat including opening and pit construction and oil and gas development. The analysis area includes all private and NFS lands within the proclamation boundary and because habitat for this species is temporary in nature, in order to identify present condition habitat, the start of the analysis period is 1986, whereas the 2060 is considered the end of the analysis period.

Effects common to all alternatives

The forest is being affected by a variety of insect and disease related impacts and changes currently taking place as a result of introduced insects and mortality/decline are expected to continue. While the rate of change will be set by the interaction of natural forces such as drought, native and exotic insect defoliations, windstorms and atmospheric deposition, the overall effect of these forces are expected to result in an opening up of the forest canopy due to tree mortality and

decline. Generally, this is expected to promote development of understory conditions that are preferred by the mourning warbler, although local deer populations and resultant deer browsing will determine whether or not desired understory conditions develop.

Oil and gas development is assumed to be constant across all alternatives and based on past and anticipated future development, it is anticipated that approximately 5 percent of the analysis area will be made unsuitable due to the conversion of forest to non-forest habitat.

Effects by alternative

Both even- and uneven-aged timber harvest create suitable mourning warbler habitat and Table 3-62 displays the total amount of early structural (resulting from even-age management) and multi-structural (resulting from uneven-aged management) habitat on NFS and State/private lands within the proclamation boundary.

In addition to timber harvest, each of the alternatives will result in some loss of forested habitat due to opening construction, pit development and new road construction and this, combined with the five percent loss of forest cover resulting from OGM development and existing openings would create unsuitable mourning warbler habitat on approximately 21 percent of the analysis area. Conversely, by the sixth decade, it is anticipated that approximately 79 percent of the analysis area will continue to occur as potentially suitable forested habitat, whereas preferred habitat created through management would occur on 22 percent, 20 percent, 18 percent and 13 percent of Alternatives A, B, Cm, and D respectively (Table 3-72).

While there will be a reduction in suitable habitat under all alternatives, considering that almost 80 percent of the analysis area will continue to exist as potentially suitable habitat and that preferred habitat conditions will be created on at least 13 percent of the area, there is not expected to be a reduction in viability for this species under any alternative.

Table 3-72. Cumulative effects mourning warbler habitat by alternative in the sixth decade (percent of the analysis area boundary)

	Alt. A	Alt B	Alt. Cm	Alt D
High density habitat created	22	20	18	13
Unsuitable lands (nonforest)	21	21	21	21
Total suitable habitat ¹	79	79	79	79

¹ includes NFS, state, and private lands

Habitat indicator 5 – Amount and trends in habitat for game species**Introduction**

Cumulative effects to habitat for game species are influenced by changes in the amount of early structural habitat, changes in habitat composition (especially mast producing species such as oaks and beech), changes in winter ranges and brood rearing habitat including loss of hemlock thermal cover. Changes in water quality and invasion of zebra mussels can impact habitat for game fish.

Effects by alternative

Early structural habitat will increase by 2060 under Alternatives A, B, and Cm and decline under Alternative D. The increase will benefit deer, bears, grouse and woodcock, and to a lesser extent turkeys. Under Alternative D, the quality and quantity of terrestrial habitat for game species would generally decline from present conditions.

Lack of investments in reforestation practices in oak habitats on private non-industrial lands will result in a cumulative decline in quality oak habitat in the four-county area by 2060. Red maple is likely to become more prominent in oak forests where concerted efforts are not made to establish oak seedlings. Coupled with a substantial loss of beech mast associated with beech bark disease, fall and winter food sources for game species will decline unless Federal, State, and industrial forest landowners place special emphasis on sustaining oak forests to provide acorn mast for wildlife.

Habitat loss and disruption of deer and turkey winter ranges and turkey brood rearing habitat will increase over the long term on Federal and non-Federal lands due to continuing mineral development, road construction, trail construction and residential/industrial development. Hemlock woolly adelgid will impact as much as 50 percent of the hemlock, reducing the quality of winter thermal cover for deer and turkeys.

The cumulative effects described for Rivers, Streams, and Impoundments are the same for game fish. Of most concern is the brook and brown trout, highly sought after game species that are affected by stream water with low pH, or acidic conditions. These species are most susceptible in headwater streams as a result of acidic runoff during rain or snowmelt events. Several streams on the ANF currently have pH levels too low to support trout or trout in any abundance. The continuation of acid deposition coming from outside the ANF will continue to affect streams and their ability to support trout.

The occurrence of zebra mussels in the Allegheny River upstream of the Allegheny Reservoir (and outside of the ANF) are now a concern to the game fisheries in the reservoir. Over the next several years, it is likely they will migrate downstream and eventually populate the reservoir. It is not certain what the ultimate effects of this would be, but other lakes that have a population of zebra mussels have seen water clarity become clearer. Particulate matter, including phytoplankton and some small forms of zooplankton, are removed. These microscopic plants and animals are the base of the food chain. Small fish, such as young sport fish or forage fish depend on this food for survival and growth. The long-term consequences of removing so much food from the environment are still being studied.

Habitat indicator 6 - Species with viability concerns

A viability outcome was determined for each of the 78 species identified during the species viability evaluation process. A range of five viability outcome levels was developed for use by Eastern Region National Forests to facilitate the comparison of species viability under each alternative in forest plan revision. The viability outcome should be thought of as an index of the capability of the environment to support population abundance and distribution, but not as an actual prediction of population occurrence, size, density or other demographic characteristics. A viability outcome is a judgment, based on scientific information found in the literature and from discussion with taxonomic experts and it does not make a yes-or-no determination of viability. It is important to note that the concept of ecological conditions, distribution and quality must be based on the knowledge of the species distributional range and life history. For example, some species may have received a viability outcome level of D or E. The reader must realize that many plants and animals occur in a localized or patchy distribution, and thus would never occur in the conditions described in outcome levels A, B, or C. The uncertainty associated with determining outcomes is acknowledged.

Viability outcomes based on all lands within the ANF proclamation boundary

These outcome descriptions were used for determining present condition and cumulative effects in the short term (2020) and long term (2060) by alternative for all lands (both NFS and non-NFS lands) within the proclamation boundary. Historical conditions are those that persisted prior to European settlement.

Outcome A. The combination of environmental and population conditions provides opportunity for the species to be broadly distributed and of high abundance across its historical range within the cumulative effects analysis area. There is potential for continuous or nearly continuous intraspecific interactions at high population size.

Outcome B. The combination of environmental and population conditions provide opportunity for the species to be broadly distributed and/or of high abundance across its historical range within the cumulative effects analysis area, but there are gaps where populations are potentially absent or present only in low density as a result of environmental or population conditions. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the cumulative effects analysis area.

Outcome C. The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or zero is large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition may have resulted from this isolation.

Outcome D. The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by areas with high potential for population isolation

and/or very low potential abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough that there is limited opportunity for interactions among them. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical has likely resulted from this isolation.

Outcome E. The combination of environmental and population conditions restricts the potential distribution of the species, which is characterized by high levels of isolation and very low potential abundance. Gaps where the likelihood of population occurrence is low or zero are large enough there is little or no possibility of interactions, strong potential for extirpations, and little likelihood of recolonization. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.

The short- and long-term cumulative outcomes for species with viability concerns grouped by broad primary habitat are displayed in Table 3-73. Detailed outcomes for each species are provided in Appendix E. A summary of the rationale for species whose cumulative outcomes change from the present condition is provided below.

Mid to late structural habitat

Northern flying squirrel – Habitat for this rare species is mature hemlock and mixed conifer/hardwood forests usually in association with a water source such as a stream. Suitable habitat is confined to the 15,335 acres of “riparian conifer” on the ANF. Only one location of the northern flying squirrel is currently documented within the proclamation boundary, although much of the potential habitat has not been adequately surveyed. Nest box surveys are continuing. Suitable habitat is somewhat isolated with some large gaps. Although occurrence and distribution data is limited it appears that subpopulations are somewhat isolated with limited species interactions. Based on the historic distribution of hemlock on the ANF, it is likely that reduction from historic conditions may have isolated some subpopulations. The outcome for the present condition is C.

The primary cumulative effect that would occur under all alternatives is the loss of hemlock due to the spread of the HWA. Estimates are that 10 percent of the hemlock will be impacted by 2020 and 50 percent by 2060. A secondary impact would occur from land clearing associated with oil and gas development. In most cases, access to private minerals would occur without substantial impacts to riparian conifer habitat. It is difficult to quantify the amount of potential habitat that could be impacted by oil and gas development, but 38 percent of the total conifer on the ANF is in known oil and gas fields. Both HWA and oil and gas development would result in suitable habitat being frequently isolated with large gaps. Most subpopulations would be isolated with limited species interactions. The reduction in habitat from historic conditions may have isolated most subpopulations. The outcome for all alternatives for both 2020 and 2060 is D.

Northern goshawk – The northern goshawk utilizes predominantly mature forest with conifer embedded within diverse landscapes. Suitable landscape, foraging, and nesting habitat occurs on approximately 87 percent, 92 percent and 79 percent of the ANF respectively. Suitable habitat is presently fairly well

distributed with some gaps in nesting habitat due to high density roads and oil and gas activity. Although recent nesting success has dropped for unknown reasons, the ANF has supported a fairly stable population for the last 15 years and there have been 12 active territories documented within the last five years. Because suitable habitat is well distributed and goshawk populations appear to have been relatively stable, the current outcome for this species is B.

The change in outcome for the northern goshawk results from anticipated future OGM development. It is anticipated that by 2020, between 25 and 30 percent of lands within the proclamation boundary will have levels of OGM activity that create unsuitable or marginally suitable goshawk habitat; whereas by 2060, unsuitable habitat could occur on up to 50 percent of lands within the proclamation boundary. These increased levels of fragmentation and disturbance will reduce nest habitat, as well as reduce landscape level habitat. Although there will continue to be large areas on the ANF where OGM activity is not expected to occur, there are expected to be some large gaps in remaining suitable habitat. Additionally, up to 50 percent of the forestwide hemlock could be lost due to the HWA and for these reasons, outcome C better reflects the viability of this species both in the short (2020) and long term (2060).

Swainson's thrush – Although the Swainson's thrush utilizes second growth forest, it is considered an obligate of conifer and mixed hardwood/conifer forest and is strongly associated with riparian/wetland habitat. Although conifer and preferred habitat is well distributed, this species has only been documented on approximately 20 percent of the sites surveyed on the ANF and the current viability for this species is outcome B.

The change in viability for this species is directly related to the potential loss of conifer that could occur as a result of the HWA. While it is estimated that only 10 percent of the conifer within the proclamation boundary could be lost by 2020, by 2060, mortality on up to 50 percent of the forestwide conifer could occur. As a result, and considering this species requirement for conifer, it is anticipated that by 2060, outcome C will better reflect the viability of this species because suitable ecological conditions may be distributed frequently as patches and because large gaps in suitable habitat may occur, further reducing its range within the planning unit from historical conditions.

Timber rattlesnake – The current status of this species is that it has declined from historic numbers and continues to decline across Pennsylvania. There is currently suitable denning, foraging and basking sites on the ANF but they are broadly distributed and the species is uncommon. The outcome for the present condition of the timber rattlesnake is C. By the year 2060, the magnitude of adverse impacts from oil and gas road construction activities increases to the point where the viability outcome changes (3,000 miles of new oil and gas roads estimated). The result is that suitable habitat is frequently isolated with large habitat gaps. Most subpopulations are isolated with limited opportunity for most subpopulations to interact. The result is a viability outcome of D.

Aquatic

Nine fish, eleven dragonflies, and twelve mussels are projected to have a decrease in the short- or long-term cumulative outcome from the present condition. This decrease is primarily a result of the projected influx of zebra mussels from Conewango Creek and the upper Allegheny River in New York into the

ANF section of the Allegheny River where a large amount of suitable habitat exists for aquatic species with a viability concern. As zebra mussels become established, their colonization of suitable habitat and feeding habits will alter the conditions that these aquatic species prefer. Zebra mussels will colonize directly on native mussels leading to direct impacts. Zebra mussels can also alter habitat and food sources used by fish and aquatic insects. The projected level of privately-owned oil and gas developments that would occur on the Forest was not a primary reason for the outcomes because LRMP standards and guidelines and/or site-specific mitigation measures are expected to be implemented by the developers to protect aquatic species.

Fish

Bluebreast darter and longhead darter - These two species have a similar distribution based on surveys conducted on the ANF, although the bluebreast appears to occur in greater numbers. They occur in the Allegheny River and Tionesta Creek, both providing an abundance of suitable habitat but which is not broadly distributed across the ANF. The present condition outcome for the bluebreast darter is B and for the longhead darter is C. Considering zebra mussels as the primary effect in the Allegheny River, the projected cumulative outcome for the bluebreast darter is C and for the longhead darter is D in 2020 and 2060.

Channel darter - Suitable habitat for this species is abundant and occurs in the Allegheny River and Tionesta Creek; and recently, collections were made in several tributaries to the Allegheny Reservoir increasing the amount of known suitable habitat on the Forest. There are now three meta-populations on the Forest that includes Tionesta Creek, Allegheny River downstream of Kinzua Dam, and Allegheny Reservoir tributaries (possibly including the reservoir itself). The present condition outcome for the channel darter is C. Considering zebra mussels as the primary effect, the cumulative outcome for the channel darter is C in 2020 and as zebra mussels become more established, the cumulative outcome drops to a D in 2060.

Gilt darter - The gilt darter has a patchy distribution across the ANF. Having been collected in several streams, it has never been found in any abundance; and actually only individual specimens have been documented at most sites. Suitable habitat for the gilt darter could be considered somewhat abundant, but not necessarily is it broadly distributed. By far, suitable habitat is most abundant in the Allegheny River. The outcome for the gilt darter for the present condition is C. As a result of a likely zebra mussel infestation that would impact suitable habitat in the Allegheny River, the outcome for the gilt darter is C in 2020 and as zebra mussels become more established in the river, the outcome drops to a D in 2060.

Gravel chub, mountain madtom, northern madtom, spotted darter, tippecanoe darter - These five species are only known to occur in the Allegheny River within the ANF, with the exception of the Tippecanoe darter which was recently documented in Brokenstraw Creek near its mouth with the Allegheny River. Suitable habitat is abundant in the river, but it's not broadly distributed across the ANF. The river has been surveyed for fish, but only sporadically and at sites many miles apart. These species are rarely collected, and as a result, it is difficult to state with any degree of certainty whether subpopulations exist within the river, and if so whether they are interacting. The

outcome for the present condition for these five species is C. Considering zebra mussels as the primary effect to populations and habitat in the river, and the apparent low numbers for each species, the cumulative outcome for the five species is D in 2020 and 2060.

Mussels

Clubshell and northern riffleshell - Suitable habitat is limited to the Allegheny River which, because of its size, provides an abundance of habitat. As a result of being limited to the river, suitable habitat is not broadly distributed across the ANF. The outcome for the present condition for both species is B. Considering zebra mussels as the primary effect, the cumulative outcome is C for both species by 2020 and D by 2060.

Longsolid and round pigtoe - These species' have been documented in Tionesta Creek and the Allegheny River. Suitable habitat is abundant, but is not well distributed across the Forest. Their primary habitat is likely the Allegheny River which is more productive. The outcome for the present condition for the longsolid is C and for round pigtoe is B. Considering zebra mussels as the primary effect, the cumulative outcome for both species is C by 2020 and as zebra mussels become more established in the river, the outcome goes to D by 2060.

Rabbitsfoot, rainbow, sheepnose, snuffbox, threeridge, wabash pigtoe, white heelsplitter - These seven species' are rare, having only been documented in extremely low numbers in the Allegheny River. Like all the other mussel species, there is abundant suitable habitat in the river, although not well distributed across the ANF. Based on recent surveys, each species' has only been documented from one, two, or three sites within the river and within either the proclamation boundary or wild and scenic river corridor. Because of the extremely limited occurrence for each species, it would appear that each species has a high probability to be isolated and have limited ability to interact. The outcome for these mussels is C for the present condition. Considering zebra mussels as the primary effect, the cumulative outcome for these mussels is D by 2020 and 2060.

Rayed-bean - The rayed-bean has been documented in the Upper Allegheny River in several locations, but never in any abundance. Suitable habitat is abundant in the river, but is not broadly distributed across the Forest. The outcome for the present condition for this species is B. Considering zebra mussels as the primary effect, the cumulative outcome for the rayed-bean is C by 2020 and as zebra mussels become more established in the river, the cumulative outcome goes to D in 2060.

Aquatic invertebrates

Green-faced clubtail, mustached clubtail, rapids clubtail, resolute damsel - The Clarion River is the only location where these species were collected during a survey of several streams across the ANF. Because of its large size, the river provides an abundance of suitable habitat. The Allegheny River, although not part of the survey, also provides an abundance of suitable habitat. However, based on the data collected from the surveys, these species are presumed not to be broadly distributed. The outcome for the present condition is B for the four species. As a result of

the likely zebra mussel occurrence in the Allegheny River, the cumulative outcome for the four species would stay at a B through 2020, but as zebra mussels become more established in the Allegheny River the cumulative outcome decreases to C by 2060.

Harpoon clubtail, maine snaketail, ocellated darter, zebra clubtail - Suitable habitat for these species appears to be broadly-distributed and abundant based on surveys conducted on several streams across the ANF. While the Allegheny River was not a survey site, it does provide abundant suitable habitat. The outcome for the present condition is B for the four species. As a result of the likely zebra mussel occurrence in the Allegheny River, the cumulative outcome for the four species would stay at a B through 2020, but as zebra mussels become more established in the Allegheny River the cumulative outcome decreases to C by 2060.

Midland clubtail, ski-tailed emerald, Uhlers sundragon - Based on surveys conducted across the ANF, it appears these species are not broadly distributed as documented in surveys of several moderate sized streams. It is not clear if it's because habitat is only occasionally encountered or is rare and habitat is poorly distributed. While the Allegheny River was not a survey site, it does provide abundant suitable habitat. The outcome for the present condition is C for the three species. As a result of the likely zebra mussel occurrence in the Allegheny River, the cumulative outcome for the three species would stay at a C through 2020, but as zebra mussels become more established in the Allegheny River the cumulative outcome decreases to D by 2060.

Riparian/wetland

Eastern box turtle - Suitable ecological conditions, in the form of riparian corridors, streams and mature forest, are widely distributed across the forest. The current status of this species on the ANF is unknown and population centers are unknown, which makes it more difficult to protect this turtle. The outcome for the present condition of the eastern box turtle is B. Cumulative conditions under all alternatives would remain the same on ANF lands, but are uncertain for private and other agency lands. While riparian areas on private lands may not be directly affected, there may be more indirect effects as developments of oil and gas and structures increase. In addition, the home range of this species is relatively small so it is sensitive to habitat destruction. Because the eastern-box turtle has such a small home range and populations and nesting success is difficult to estimate, if one subpopulation is destroyed, interaction between subpopulations could be restricted. The cumulative outcome for this species declines to outcome C for all alternatives in both the short and long term.

Wood turtle - Suitable ecological conditions, in the form of riparian corridors, streams and mature forest, are widely distributed across the forest. The current status of this species on the ANF is unknown and population centers are unknown, which makes it more difficult to protect this turtle. The outcome for the present condition of the wood turtle is B. Cumulative conditions under all alternatives would remain the same on ANF lands, but are uncertain for private and other agency lands. While riparian areas on private lands may not be directly affected, there may be more indirect effects as developments of oil and gas and structures increase. In addition, the home range of this species is relatively small so it is sensitive to habitat destruction. Because the wood turtle has such a small home range and populations and nesting success is difficult to estimate, if one subpopulation is destroyed, interaction between subpopulations

could be restricted. The cumulative outcome for this species declines to outcome C for all alternatives in both the short and long term.

Plants - Of the 23 plant species evaluated with viability concerns, none change viability outcome by alternative or by length of effect for direct or indirect effects. However, one species, butternut (*Juglans cinerea*), changed from a present condition of D to E for all alternatives under the cumulative effects analysis for 2060. Suitable habitat (open, bottomland/floodplain forests) is frequently isolated and exists at very low abundance. Butternut is shade intolerant and must have open conditions to thrive and reproduce. Most bottomland/floodplain forest across the ANF is closed canopy or inundated with non-native invasive herbaceous species. Large gaps are common and most subpopulations are considered isolated with limited opportunity for most subpopulations to interact. Reduction from historical conditions may have resulted in isolation of most subpopulations from the loss of Native American burning within river valleys and the reduction of floodplain scour in the Allegheny River. As a result of butternut canker (*Sirococcus clavigignenti-juglandacearum*), the species is susceptible to high mortality and high rates of infection. Between the years 1980 to 1994, there was a dramatic decrease in the number of live butternut trees throughout the United States. In many instances populations were down over 75 percent. There is no known cure for this fungal disease (canker) and it may eliminate the species (Ostry *et al.* 1994). The extent of infection on the ANF is currently unknown; however, work with the Forest Service Region 9 Regional Geneticist is continuing to evaluate butternut status on the ANF. Present condition outcome is D. Suitable habitat continues to be frequently isolated and exists at very low abundance across the cumulative effects area. Large gaps are common and most subpopulations are considered isolated with limited opportunity for most subpopulations to interact. The outcome for all alternatives for 2020 remains D. However, in the long term (2060), the outcome drops to E as a result of canker mortality.

Table 3-73. Species with viability concerns – outcomes by primary broad habitat by alternative for cumulative effects

	Existing Condition (number of species)	Cumulative Effects – 2020 (number of species by alternative)				Cumulative Effects – 2060 (number of species by alternative)			
		A	B	Cm	D	A	B	Cm	D
Mid-Late Structural Forest									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	8	7	7	7	7	6	6	6	6
Outcome C	4	4	4	4	4	4	4	4	4
Outcome D	7	8	8	8	8	9	9	9	9
Outcome E	0	0	0	0	0	0	0	0	0
Mid-Late Structural Oak Forest									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	1	1	1	1	1	1	1	1	1
Outcome C	1	1	1	1	1	1	1	1	1
Outcome D	1	1	1	1	1	1	1	1	1
Outcome E	0	0	0	0	0	0	0	0	0
Aquatic (rivers, streams and impoundments)									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	13	8	8	8	8	0	0	0	0
Outcome C	23	15	15	15	15	13	13	13	13
Outcome D	1	14	14	14	14	24	24	24	24
Outcome E	0	0	0	0	0	0	0	0	0
Riparian/Wetlands									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	2	0	0	0	0	0	0	0	0
Outcome C	2	4	4	4	4	4	4	4	4
Outcome D	10	10	10	10	10	9	9	9	9
Outcome E	1	1	1	1	1	2	2	2	2
Grassland/Seedling/Sapling									
Outcome A	0	0	0	0	0	0	0	0	0
Outcome B	0	0	0	0	0	0	0	0	0
Outcome C	0	0	0	0	0	0	0	0	0
Outcome D	3	3	3	3	3	3	3	3	3
Outcome E	1	1	1	1	1	1	1	1	1

Federally listed threatened, endangered, and candidate species

Cumulative effects to Federally-listed threatened, endangered, and candidate species are addressed in detail in the Biological Evaluation. The following is a brief summary of the cumulative effects.

Indiana bat

Overstory stocking levels on non-Forest Service lands within the four-county area indicate that suitable and optimal foraging and roosting habitat is currently plentiful and well distributed (Vegetation cumulative effects Table 3-40). The amount and distribution of snags across all lands is likely sufficient to support the occasional use by Indiana bats that currently exists. Trends in overstocking stocking levels and the amount and distribution of snags are expected to continue over the long term. No cumulative impacts to Indiana bats are anticipated.

Bald eagle

Over 94 percent of National Forest System (NFS) lands within the analysis area are forested and because the majority of these lands are managed in a manner that maintains or enhances bald eagle habitat, the condition of these lands is not expected to change during the analysis period. Although some development of private lands within the analysis area is expected to occur, due to the high scenic and recreational values associated with lands near the Allegheny and Clarion Rivers, it is anticipated that primary bald eagle habitat on non-NFS lands will remain for the most part in their existing condition.

Although it is anticipated that some primary bald eagle habitat will be adversely affected by oil and gas development, compliance with State permitting and protection of known eagle nests, implementation of State BMPs related to water quality and erosion control, close coordination with resource specialists during all development that occurs on the ANF and operator compliance with the Endangered Species Act, are expected to reduce or minimize potential impacts.

Recreational use

It is anticipated that there will continue to be heavy recreational use of rivers and other waterways within the cumulative effects analysis boundary and that this use would result in some adverse eagle/human interactions. However, recreational use along primary eagle nesting and foraging habitat has been taking place on the ANF for decades. Also ANF-monitoring indicates that eagles successfully nest and forage in areas that receive high levels of recreational use. As a result, and considering eagle nesting and use within the analysis area has been increasing the last 10-12 years, anticipated impacts from recreational use is anticipated to be short term and temporary.

Activities proposed on ANF lands

Activities that may adversely affect the bald eagle or its habitat are discussed under direct and indirect effects. Any potential adverse cumulative effect that may occur as a result of implementation of these activities would be mitigated through implementation of Forest-wide standards and guidelines incorporated into each alternative. Additionally, with implementation of management direction described above under activities likely to benefit the bald eagle, and considering cumulative effects analysis related to water quality discussed under the clubshell and northern riffleshell mussels, there are no significant cumulative effects to the bald eagle or its habitat anticipated under any alternative.

Clubshell and northern riffleshell

The primary cumulative effect to these two mussels is the projected influx of zebra mussels from Conewango Creek and the upper Allegheny River in New York into the ANF section of the Allegheny River where a large amount of suitable habitat exists and populations occur. Zebra mussels are slowly making their way into the Allegheny River system approaching known locations of these two endangered species. The long-term cumulative effect could result in a substantial reduction in the population of these two species from the Allegheny River.

The projected level of privately-owned oil and gas developments that would occur on the Forest could have cumulative effects on these mussels habitat. To minimize these effects, primarily from runoff, Forest Plan standards and guidelines and/or site-specific mitigation measures are expected to be implemented by the developers to protect aquatic species.

Small whorled pogonia

A decrease in the quality of oak habitats on private non-industrial lands could result in adverse cumulative effects to this orchid. Deer densities must be maintained at low levels across the landscape to reduce the potential for this species being consumed by deer.

Northeastern bulrush

The survival and sustainability of this wetland species depends on the effectiveness of wetland regulations to protect the quality of wetlands. Threatened by increases in sedimentation from road construction and oil and gas development over the long term, some cumulative effects are likely but difficult to quantify.

Candidate species – sheepsnose and rayed-bean

Although no adverse impacts are anticipated from Forest Service activities, zebra mussel infestation of the Allegheny River is projected to result in long-term cumulative effects similar to those discussed for the clubshell and northern riffleshell.

3.3.3 Non-native invasive plant species

Introduction

The ANF Botany Program encompasses an integrated ecosystem management approach to managing the botanical resources of the ANF. A major component of the program is invasive plant prevention, early detection of new species, treatment and monitoring. Treatment typically involves several methods either used alone or in combination to effectively treat unwanted vegetation. The ANF contains both native and non-native invasive plant species that pose significant threats to forest health and ecosystem sustainability.

Non-native invasive species (NNIS) were identified as a component of the Habitat Diversity Need for Change issue. Executive Order 13112 (1999) defines alien (non-native) species as “with respect to a particular ecosystem, any species including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.” Invasive species is defined as “an alien species whose introduction does or is likely to cause, economic or environmental harm or harm to human health.” While many non-native species have proven to be beneficial, it has been clearly demonstrated (US Congress 1993, p. 3-5) that numerous other non-native, invasive plant/pest species have caused billions of dollars of damage to the nation's agriculture, environment and economy. These species have radically interfered with the production of crops and timber and the interrelationships of other living organisms in both aquatic and terrestrial ecosystems; reducing biological diversity by eliminating some species and threatening and endangering others.

Affected environment

Many factors may influence the ability of a particular plant species to become established into new areas and the extent to which a particular species becomes established. Biological, physical, and environmental barriers effect plant invasions. Biological barriers may include low seed production, viability, or dispersal limitations. Physical barriers may include distance traveled, topography, or habitat type and structure. Environmental barriers may include available light conditions, soil and moisture regimes (Parendes and Jones 2000).

Of the approximately 1,200 vascular plant species on the ANF, over 250 are non-native and a subset of those are considered invasive plant species of concern. Currently there are 30 species that occur within the ANF proclamation boundary that are identified as invasive plants of concern. These species are the focus of current inventory and control efforts.

Of these species, 17 are considered highly invasive; with the potential to invade natural habitats and replace native species. These include species that are well-known for seriously disrupting the plant species composition of forested and/or riparian communities such as garlic mustard (*Alliaria petiolata*), Japanese barberry (*Berberis thunbergii*), purple loosestrife (*Lythrum salicaria*), Japanese knotweed (*Polygonum cuspidatum*), common buckthorn (*Rhamnus cathartica*), and glossy buckthorn (*Rhamnus frangula*).

Thirteen species are considered less invasive than those, and include native and non-native plants. Many of these are found primarily in disturbed areas, openings, or along roadsides, in areas ranging from full sun to partial

shade. These include species such as, dame's rocket (*Hesperis matronalis*), Canada thistle (*Cirsium arvense*), Bull thistle (*Cirsium vulgare*), and multiflora rose (*Rosa multiflora*).

Six species are on the ANF's Early Detection list. Other plants not known to occur on the ANF but are nearby, including leafy spurge (*Euphorbia esula*), that occurs on private lands within the proclamation boundary.

The majority of invasive plant species of concern on the ANF are shade intolerant species that occur along roads, right-of-ways and other open canopy areas. Most areas of infestation are small and scattered within these sites. A few shade tolerant species are considered significant threats due to their habitat preference for riparian, wetland and forested areas. These species often cause larger areas of infestation.

A comprehensive survey of invasive plants has not yet been completed on the ANF. An estimate based on surveys of the most infested areas, roadsides and riparian areas, approximately 20,000 acres are infested. Based on project level NNIS surveys, most infestations are generally small (less than 2 acres) and scattered.

The LRMP contains new guidelines for NNIS. Forestwide, activities that may contribute to the introduction, establishment or spread of invasive plant species should be designed to include measures to reduce impacts as well as treatment and/or monitoring requirements. To determine the appropriate measures, managers will consult resources such as the "Forest Service Guide to Noxious Weed Prevention Practices." Special use permits and contracts for activities conducted on the ANF should include appropriate clauses for the prevention and/or treatment of invasive plant species. Under transportation systems, noxious weed/invasive plant surveys and/or treatments should be conducted on roads prior to decommissioning. Under land acquisition and disposal, noxious weed/invasive plant surveys and/or treatments should be conducted on lands considered for acquisition or disposal. As a condition of land adjustment decisions, the ANF may also require the proponent to treat noxious weeds/invasive plants on lands prior to acquisition.

Direct and indirect effects

Scope of the analysis

The scope of this analysis is primarily focused on the direct and indirect effects associated with the 506,000 acres of National Forest administered lands. It is assumed that ANF management activities will remain fairly constant over the first two decades. However, due to uncertainties in current amount of infested acres, new species introduction, species information (amount in a reproductive stage) and rates of spread which typically can be exponential as infestations increase, it is difficult to estimate the amount of NNIS in the future with any certainty.

Introduction to effects

All of the action alternatives are subject to plan direction that calls for reducing the risk of NNIS invasion and spread from Forest Service activities. Activities that cause ground disturbance and/or opening-up of the forest canopy have the potential to facilitate the introduction and spread of several NNIS of concern. The level of disturbance it takes to do so varies by plant species, habitat type disturbed, and current environmental conditions. The complexities and uncertainties with regard to predicting how each type of activity will directly and indirectly effect NNIS limit the ability to predict absolute outcomes by alternative. The majority of invasive plant species of concern are shade intolerant species occurring along roads, right-of-ways and other open canopy areas. Most areas

of infestation are small and scattered within these sites. A few shade tolerant species are considered significant threats due to their habitat preference for riparian, wetland and forested areas and are often larger areas of infestation.

Direct and indirect effects will be evaluated by considering management activities that may cause ground disturbance and/or opening-up of the forest canopy have the potential to facilitate the introduction and spread of several NNIS of concern. Forest Service activities that pose the greatest risk of introduction and/or spread of NNIS include vegetation management, road management, gravel pits, burning, mechanical hazard fuel treatments, wildlife opening creation, trails, intensive use and equestrian use areas.

Effects by alternative

Effects of vegetation management

Vegetation management proposed under all alternatives is expected to create conditions conducive to the spread of NNIS. As mentioned previously, the potential for introduction and spread depends on a number of factors, including the presence of a seed source and dispersal vectors.

Treatments that involve removing varying amounts of overstory will improve growing conditions for shade intolerant NNIS, but because of the temporary nature of the openings this is expected to be a short-term effect. Within 10 years after harvest, herbaceous and shrubby vegetation are overtopped and are starting to disappear from the stand and that by the time the stand is 10-15 years old, the canopy has closed and the site no longer provides desirable growing conditions for shade intolerant vegetation.

Since many NNIS populations exist in roadways, it is possible that logging equipment used on these sites could facilitate the spread of existing NNIS by carrying seeds or reproductive fragments into other areas. In order to reduce the possibility of indirect spread off site, an equipment cleaning clause is included in timber sale contracts.

The total amount of proposed vegetation management (even and uneven-aged harvest) under Alternatives A, B, and Cm reflects a 12 percent change in the first decade and a 15 percent change in the second decade across all alternatives in the number of acres treated annually. Under Alternative D, there is a large decrease in the number of acres of vegetation management compared to the other alternatives. The effects under all alternatives are considered similar and with implementation of LRMP direction and/or site specific mitigation measures there are no significant direct or indirect effects anticipated under any alternative.

Effects of road management (construction, reconstruction, decommissioning, access)

Building roads into a forest's interior and subsequently maintaining them (including ditch clearing, road grading, and vegetation clearing) represent disturbances that create and maintain new edge habitat. These roadside habitats can be invaded by a suite of non-native plant species, which may be dispersed by "natural" agents such as wind and water as well as by vehicles and other agents related to human activity. Roads may be the first point of entry for exotic species into a new landscape, and the road can serve as a corridor along which the plants move farther into the landscape. Some exotic plants may then be able to move away from the roadside into adjacent patches of suitable habitat (Gucinski *et al.* 2000). Establishing

desired vegetation quickly will aid in reducing the potential for NNIS establishment. Current NNIS infestations are most commonly found along roadsides. Road corridor width and disturbance regimes (brushing, mowing, clearing, etc.) and use influence the potential for infestation and spread of many NNIS plant species.

The current number of Forest System roads is approximately 1,270 miles. Under Alternatives A, B, and Cm, by the end of the second decade, there is a projected increase in FS road miles of approximately 20-30 percent and a 20 percent increase under Alternative D. The effects under all alternatives are considered similar and with implementation of LRMP direction and/or site specific mitigation measures there are no significant direct or indirect effects anticipated under any alternative.

Gravel pits

Direct effects from gravel pit creation and/or expansion include creating open areas of disturbed soil that may become infested with NNIS if changes to physical and environmental barriers are sufficient for a particular species, appropriate dispersal vectors are available, and there is an adequate seed source. Indirect effects of pit creation and/or expansion may include the introduction or spread of species from equipment containing viable seed or reproductive fragments.

Under all alternatives there are an additional 50 acres of gravel pits by the end of the first and second decades (Table 2.2). The effects under all alternatives are considered similar and with implementation of LRMP direction and/or site specific mitigation measures there are no significant direct or indirect effects anticipated under any alternative.

Motorized recreation - IUAs and trails

Any existing NNIS populations along the existing or proposed trails have the potential to spread with any ground disturbance and/or opening of the canopy. Three main management concerns are associated with invasive species: (1) increased vehicle traffic and human activity may introduce new invasive species; (2) ground disturbance during trail construction creates favorable conditions for early structural, weedy species; and (3) existing weedy species may be spread along new trails. To avoid and minimize the introduction, propagation, and spread of invasive species, mitigation, monitoring, and treatment will be needed.

Alternative B has the greatest number of acres in IUAs (Table 2-1) and the largest number of miles of motorized trails constructed by the end of the second decade (Table 2-2). Therefore, the risk of introduction and spread of NNIS due to motorized recreation is greatest under Alternative B. Alternative D is considered to result in the least risk of introduction and spread of NNIS. The amount of trails that these areas would support would be determined by a site specific project analysis. However, it is assumed that Alternative D would have less impact from NNIS than the other alternatives.

Equestrian Use Areas

Equestrian use areas proposed under Alternatives B, Cm, and D would aid in monitoring the potential impacts from NNIS introduction from forage, bedding and other materials associated with horses since areas with designated trails or open riding areas are delineated. This is compared to Alternative A, where

user-created trails and open riding can occur across the ANF. Under Alternative D, horse use is prohibited anywhere outside of EUAs, while Alternatives B and Cm allow some open riding. However, the potential impacts are considered similar across all alternatives, and with implementation of LRMP direction and/or site specific mitigation measures there are no significant direct or indirect effects anticipated under any alternative.

Wildlife opening creation

This treatment involves removing all existing trees and establishment of a grass/forb understory on the site. By completely opening up the canopy, this treatment is expected to create conditions conducive to the spread of NNIS. However, quick establishment of vegetation on the site following construction is expected to reduce the risk for spread. Considering the small amount of acreage proposed for openings, the effects under all alternatives are considered similar and with implementation of LRMP direction and/or site specific mitigation measures there are no significant direct or indirect effects anticipated under any alternative.

Effects from NNIS treatment

Effective treatment of invasive plant species often requires different techniques (manual, mechanical, chemical, biological, etc.) based on species, site conditions, extent of infestation and available resources. This can vary by site and season and is often a long-term commitment.

Site conditions to be considered before any treatment is proposed include assessing the target species (its life stage, amount of infestation, specific threats, etc.), seasonal timing of treatment, the presence of desirable or rare species, accessibility, soil types, location of surface water, depth to groundwater, potential for off site drift, human safety and monitoring opportunities. In order to reduce the occurrence of these species within the ANF and minimize the risk of spread into other areas, manual and mechanical treatments are proposed on 500 acres per year under all alternatives, with a maximum of 110 acres per year being treated with herbicide to control NNIS under Alternatives B, Cm, and D.

Alternative A

Manual and mechanical NNIS treatment would continue under this alternative resulting in a reduction of existing NNIS within the treated area, as well as a reduction in available NNIS seed sources. These treatments may be repeated for several years if re-sprouting occurs. Existing populations may continue to spread and new species may be introduced.

Alternatives B, Cm, and D

Direct effects of herbicide treatments include direct mortality of any NNIS being treated. Indirect effects include the possible introduction or spread of NNIS by equipment containing viable seeds or reproductive fragments. Herbicides proposed for NNIS treatment are currently used for reforestation (glyphosate and sulfometuron methyl). The effects under all the action alternatives are considered similar and with implementation of LRMP direction and/or site specific mitigation measures there are no significant direct or indirect effects to other resources anticipated under any alternative.

Activities with negligible effects to NNIS

Because of the negligible amount of disturbance associated with the following actions, there are no significant direct or indirect effects to NNIS from these activities under any alternative: reforestation treatments (burning, scarification for oak, site preparation, release, fertilization, supplemental planting, tree shelters, fencing), mechanical hazardous fuel treatments, and wildlife habitat enhancements (apple tree prune and release, nest boxes, opening maintenance, shrub and tree planting, oak and white pine release, stream restoration, fish habitat structures). Most of these activities are accomplished by hand or small mechanized tools effects are small scale and short-term. Fertilization may have short-term effects NNIS species amenable to having increased levels of nitrogen and phosphorus. However, since herbicide is typically applied to these sites first to reduce herbaceous plant cover, the chance of any plants remaining to take advantage of any fertilizer is reduced. Dispersed site enhancements in CUAs (site hardening, kiosk construction, addition of fire rings or centralized vault toilets) are considered to have negligible effects to NNIS. Construction/reconstruction of developed facilities is the annual average of construction or reconstruction of developed facilities including day use areas, campgrounds, information sites, and trailheads for the first decade is one and two for the second decade. Amount of ground disturbance varies by facility type and extent of activities, however, effects to NNIS are considered negligible. If NNIS are identified as a concern, appropriate prevention/control practices should be implemented.

Cumulative effects

The cumulative effects to NNIS include effects from past, present, and future foreseeable actions from activities on Federal and non-Federal lands. The analysis area for cumulative effects is the four county area containing ANF lands. Timeframes for the cumulative effects analysis are short-term (first two decades) and long-term (six decades) and are discussed as general trends.

Cumulative effects were evaluated by identifying and evaluating direct and indirect effects of management activities on National Forest administered land, that when considered cumulatively over time and in combination with effects of actions on private land, may result in significant effects to NNIS. Based on the analysis presented under direct and indirect effects, activities most likely to result in cumulative effects from Forest Service management activities include vegetation management, road management, gravel pit development/expansion, motorized recreation – intensive use areas and trails, equestrian use areas and wildlife opening creation. Cumulative effects analysis can be seen for these activities in other sections of Chapter 3. Generally, the overall trend in the amount of these activities is an increase under Alternatives A, B, and Cm and a level similar to the past 20 years of activity in Alternative D. The potential for NNIS introduction and/or spread is assumed also to increase.

The primary non-federal activities that occur within the ANF proclamation boundary that can facilitate NNIS invasion and spread include agriculture, timber harvest, residential development, road construction and oil and gas development. Oil and gas development on both private and Forest Service administered land is predicted to have the greatest amount of ground disturbance and the greatest increase in activity in both the short and long term.

The cumulative effect to NNIS from federal and non-federal activities is an increase in land disturbed, leading to increased NNIS infested area.

3.4 Social Environment, Direct, Indirect, and Cumulative Effects

3.4.1 Recreation Opportunities and Forest Settings

This section has been updated to reflect modifications to the DEIS Alternative C.

There are various aspects of the ANF recreation program which include scenery, developed recreation, dispersed recreation, trails, interpretation and education, recreation special uses, heritage resources, national recreation areas, wilderness, wild and scenic rivers and other special areas. This section discusses specific recreation opportunities and settings related to developed recreation, dispersed recreation, and trails. The other resources listed here are discussed elsewhere in Chapter 3.

Affected environment

Recreation-related land base

Public lands make up about 14 percent of Pennsylvania's 29-million-acre land base. There are 2 million acres of State Forests, 1.4 million acres of State Game Lands, 278,000 acres of State Parks, and the ANF which represents 12 percent of the public land base. Every resident is within 25 miles of one of 116 State Parks within the State. This combination of public lands provides abundant recreational opportunities and settings for a wide variety of users.

Recreation-related expenditures

Recreation is a significant component of Pennsylvania's tourism industry, accounting for one-fifth of all leisure travel in the state. Direct expenditure for outdoor recreation travel in 1997 totaled \$4.03 billion or 33 percent of Pennsylvania's leisure-travel spending (PA DCNR 2004). Lord, Powell, and Strauss (2003) estimated that a total of \$151 million was spent by non-resident visitors in the 5-county region of Cameron, Elk, Forest, McKean, and Warren. The ANF contributes to and complements the State and private tourism markets.

National Visitor Use Monitoring survey results

Prior to the mid-1990s, the Forest Service used the Recreation Information Management (RIM) system to store and analyze recreation use information. Forest managers found they lacked the resources to simultaneously manage recreation facilities and monitor visitor use following established protocols. Both Congress and the General Accounting Office questioned the credibility of recreation visitation estimates reported by the Forest Service in RIM reports, and in 1996 RIM monitoring protocols were no longer required. The ANF used RIM from 1986 to 1996 to estimate recreation use for the 1986 Forest Plan and for reporting visitor use in the ANF Monitoring and Evaluation Reports. Since the credibility of RIM reports has been questioned, the numbers used for estimating total recreation visits over the past decade may not provide an accurate picture of the ANF's total recreation visits.

In response to the need for accurate recreation use data, the Forest Service developed a permanent sampling system known as the National Visitor Use Monitoring (NVUM) project which has been implemented nationwide. The NVUM provides statistical recreation use information at the forest, regional, and national level. A 4-year cycle has been established for data collection. The ANF participated in the NVUM project from October 2000 through September 2001. NVUM has standardized definitions of visitor use measurement to ensure that all national forest visitor measurements are comparable. These measurements include:

- National forest visit - The entry of one person upon a national forest to participate in recreation activities for an unspecified period of time. A national forest visit can be composed of multiple site visits.
- Site visit - The entry of one person onto a national forest site or area to participate in recreation activities for an unspecified period of time.
- Recreation trip - The duration of time beginning when the visitor left their home and ending when they got back to their home.

Some key survey findings include:

- Recreation use on the forest for fiscal year 2001 was 1.41 million national forest visits compared to 211,000,000 for all national forest visits across America.
- There were 1.63 million site visits, an average of 1.1 site visits per national forest visit. Included in the site visit estimate are 36,815 wilderness visits.
- The ANF contributes roughly 0.7 percent to the total visitation on national forests.
- The average length of stay on the ANF for a national forest visit was 17.4 hours.
- Roughly 15 percent of visitors stayed overnight on the forest.
- The most used facilities and areas were: forest service roads, non-motorized trails, scenic byways, developed fishing sites, and designated wilderness.
- In a typical year, visitors to the ANF spent an average of \$1,180.70 on all outdoor recreation activities including equipment, recreation trips, memberships, and licenses.
- The average recreation visitor went to 1.1 sites during their national forest visit. Forest visitors sometimes go to just one national forest site or area during their visit. For example, developed campers may just go the campground and nowhere else. About 74 percent of visitors went only to the site at which they were interviewed.
- During their visit to the forest, the top five recreation activities were relaxing, hiking/walking, viewing natural features, viewing wildlife, and driving for pleasure.

The results of the NVUM activity analysis do not identify the types of activities visitors would like to have offered nor does it tell about those who no longer visit the forest because the activities they desire are not offered.

Market area

Market area for the ANF can be defined on a local and regional scale. Locally, the market area primarily consists of users from a four-county area: Elk, Forest, McKean and Warren. Eighty percent of visitors to the ANF live within a 100-mile radius of the forest; i.e., the four-county area (USDA FS 2002-2001). To a lesser degree, visitors come from Ohio, Maryland, New Jersey, New York and West Virginia (Shifflet *et al.* 1997).

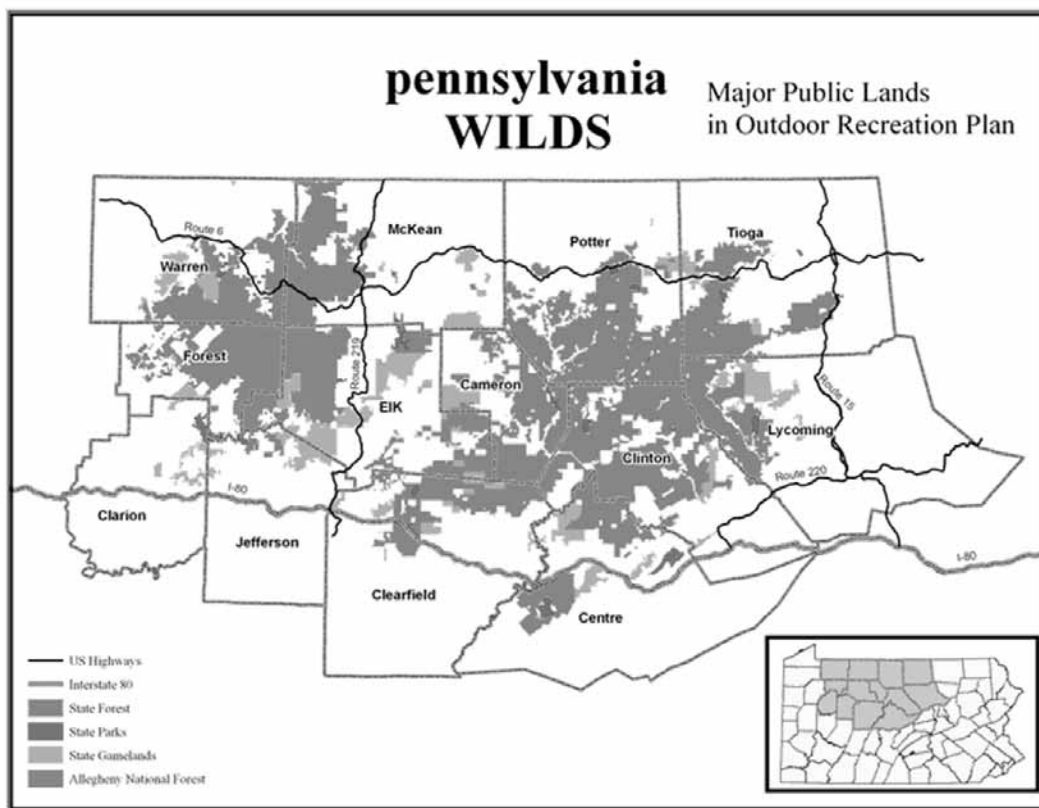


Figure 3-13. PA Wilds market area

The secondary market area consists of a regional marketing area referred to as PA Wilds. In 2004-2005, a regional marketing partnership was formed between the Pennsylvania Department of Conservation and Natural Resources (PA DCNR), the U.S. Forest Service (ANF) and the Pennsylvania Game Commission to encourage the growth of tourism primarily by highlighting and marketing outdoor recreation related experiences and activities in PA Wilds. The PA Wilds area is a 12-county region that encompasses more than 1.6 million acres of state forest and game lands, 27 state parks, and the ANF. Figure 3-13 shows the PA Wilds market area.

Recreation supply

Recreation settings

Some people desire an emphasis on undeveloped, remote recreation settings while others desire more development and easier access. The goal is to provide an appropriate mix of recreation settings for a variety of users. The FS uses the Recreation Opportunity Spectrum (ROS), a nationally recognized classification system that describes different recreation settings, opportunities, and experiences. A recreation opportunity setting includes features provided by nature or management. Nationally, recreation settings vary from primitive to rural and urban settings (see Glossary for definitions of ROS classes).

ROS is used in two different ways. The first is an inventory tool used to describe current on-the-ground setting conditions that are available on a given area. An ROS inventory was never conducted for the 1986 Forest Plan and consequently, existing conditions were never established. In 2004, an ROS inventory based on a national ROS mapping protocol was conducted for application in the LRMP. Factors that determine the ROS class for an area include: remoteness (including distance from roads and settlements), degree of naturalness (level of human modification to the landscape), social setting (number of encounters with other people within a typical day), and managerial setting (degree of visitor controls). Recreation facilities are constructed to an appropriate development level which is based on ROS.

The second way that ROS is used sets management direction to reflect “desired” ROS conditions. ROS desired conditions are typically set for land and resource management plans with the understanding that management activities may result in a change to a current inventoried setting. Both the 1986 Forest Plan and the LRMP establish desired ROS conditions for each management area. The 1986 Forest Plan established desired goals for semi-primitive ROS settings that were not met during the planning cycle. Table 3-74 provides an ROS description of classes found on the ANF, development levels, 1986 Forest Plan desired conditions, and 2004 ROS inventory results. See the discussion of Direct and Indirect Effects in this Section for desired ROS by alternative.

Remote, semi-primitive supply

The 1986 Forest Plan identifies MA 6.2 for semi-primitive non-motorized recreation on a 30 year rotational basis. Included in MA 6.2 are four areas, each approximately 5,000 acres in size. One of the four areas was entered each decade for intensive timber harvest with the remaining three areas providing a semi-primitive non-motorized recreation experience. These four areas are represented in the Map section under Alternative A. They are generally referred to as Minister Valley, Morrison, Lamentation Run (or Stony Point) and the Mill Creek/Brush Hollow/Twin Lakes area just below Kane Experimental Forest. Once intensive management and road construction occurred, the semi-primitive setting was altered, changing it from semi-primitive to roaded natural. The Mill Creek area received scheduled timber harvest from 1986-1996 and consequently; it no longer provides a semi-primitive non-motorized setting. Minister Valley was scheduled for timber harvest from 1996-2006; however, Minister Valley received reduced timber harvest intensity as that outlined for MA 6.2 in the 1986 Forest Plan. Only about 25 percent of the Minister Valley area was harvested based on the 1997 Minister Watershed Environmental Analysis. Due to the reduced timber harvest intensity, Minister Valley retained a core area of semi-primitive non-motorized ROS. Neither the Morrison nor the Lamentation Run area has received intensive timber management. Morrison no longer provides a semi-primitive setting due to extensive oil and gas development. Lamentation Run no longer provides a semi-primitive setting due to roads that dissect the area for access to adjacent private lands. In general, managing these 6.2 areas for intensive timber harvest made it difficult to achieve a semi-primitive setting once harvest activities and associated road construction occurred.

Remote, semi-primitive non-motorized types of recreation are also provided in MA 5.0 in the Hickory Creek Wilderness and MA 6.4, the Allegheny National Recreation Area.

Table 3-74. ROS classifications and acreage on the Allegheny National Forest

Development Level	ROS Class (Existing)	1986 Desired ROS (acres)	2004 ROS Inventory (acres)
Development Level 1 No facilities for user comfort; rustic and rudimentary ones for site protection. Synthetic materials excluded. No site modifications.	Primitive No areas are classified as primitive on the ANF	0	0
Development Level 2 Rustic and rudimentary facilities primarily for site protection. Avoid use of synthetic materials. Limited and subtle site modifications.	Semi-primitive, non-motorized 4 percent of the ANF, including Hickory Creek Wilderness, Minister Valley, and Tracy/Chestnut Ridge areas; Predominately natural environment that provide opportunities for non-motorized recreation; motorized trail uses not present; At least 2,500 acres and located ½ to 3 miles from roads open to motorized use	30,000	18,783
	Semi-primitive motorized No areas on the ANF. Generally areas of about 2,500 acres within ½ mile of primitive roads and 2-track vehicle trails; Mostly natural landscape with some evidence of others, but number and frequency of contacts remains low; Few management controls	133,000	0
Development Level 3 Rustic facilities providing some comfort for the user as well as site protection. Contemporary/rustic design based on native materials. Moderate site modifications.	Roaded natural Majority of the ANF (63%); Areas appear natural, but timber harvest, road construction, and rural development are frequently evident; Recreational use primarily road-based with easy access to developed and dispersed opportunities; Majority of both motorized and non-motorized trails and trailheads located within this class	342,000	325,679
	Roaded modified 12 percent of the ANF. This is a subclass of the roaded natural setting, used to help identify areas that have been heavily modified by oil and gas activity and road development; Dominated by extensive landscape alterations where resource modifications and structures are more evident than in roaded natural settings; Generally have little or no recreation development, but trails may pass through these areas	0	63,320
Development Level 4 Some facilities designed primarily for user comfort and convenience. Some synthetic but harmonious materials may be incorporated. Facility design may be more complex and refined. Moderate to heavy site modifications for facilities	Rural 21 percent of the ANF. Generally include pastoral scenes where agricultural development is evident; May also contain small towns and other rural housing developments and large highly-developed recreation areas and campgrounds; Access is primarily via conventional motorized use on roads	1,000	106,388
Development Level 5 Facilities designed for user comfort and convenience. Synthetic materials are commonly used. Facility design may be highly complex and refined. Heavy site modifications for facilities.	Urban No areas are classified as urban on the ANF	0	0

For technical definitions of ROS and development levels, see Glossary.

Developed recreation supply

Developed recreation is defined as a concentration of improvements, facilities, and services which were built primarily to encourage participation in a recreation activity and enhance visitor experiences. It includes such activities as camping at developed campgrounds, picnicking at day use sites, visiting nature, heritage or information centers and museums, gathering and staging at boat landings or launches, and fishing off developed piers or other structures.

There are 71 developed sites on the ANF with a total daily capacity of 15,138 persons-at-one-time (PAOT) days, and a season site capacity of 2,845,907 PAOT days. Table 3-75 displays developed recreation sites and capacities in greater detail. Of ANF developed recreation sites, there are 10 campgrounds included in large recreation developments that contain a variety of campsites, group shelters, picnic areas, pavilions, boat launches, trails, and/or cabins.

Approximately half of the developed recreation sites and facilities are located on the Allegheny Reservoir and were built in the 1960s. Many of the developed campgrounds feature showers, electric hookups, sewage treatment plants, and paved roads. The ANF has been involved in an extensive capital investment program over the past 12 years with major rehabilitation and expansion of most of the campgrounds and boat launches. With rehabilitation of these aging facilities, accessibility for people with disabilities has improved. However, many of the facilities on the ANF continue to have a backlog of maintenance needs.

Table 3-75. Developed recreation sites and capacity, Allegheny National Forest

Developed Site Type	Total # of Sites	Total PAOTS	Seasonal Capacity* (PAOTS)
Campgrounds	20	4,545	791,515
Cabins	6	24	8,760
Boating Sites	10	3,374	746,120
Picnic Sites	8	2,770	382,326
Swim Sites	1	1,659	169,167
Interpretive Sites	1	150	37,050
Information Sites	1	175	63,875
Observation Sites	3	651	160,797
Trailheads	21	1,790	486,297
Total Sites	71	15,138	2,845,907

*The primary season for developed sites is from Memorial Day to Labor Day (102 days) but may vary from 102 days to 365 days per year depending on the site).

There is a higher rate of use of developed recreation facilities on the weekends than during the week with an approximate 3 to 1 ratio. On most summer weekends, campgrounds around the Allegheny Reservoir

are sometimes full and boating facilities are busy. Most campgrounds elsewhere on the Forest have fewer campers. The ANF has been requiring fees and permits since the late 1960s at the developed campgrounds. The fees and permits have been tallied to account for visitation and occupancy of the sites. Table 3-76 displays the occupancy rates for several developed campgrounds over the last eight years.

The occupancy rates indicate there has been fairly static use since 1997 with an average occupancy rate of 44 percent. Occupancy rates declined fairly sharply in 2003 to 31 percent with the sharpest declines in the boat-to campsites. The highest occupancy rate was in 1999 at 52 percent and the lowest was 31 percent in 2003. Additional recreation opportunities in the area and on the reservoir are provided by private individuals, the Corps of Engineers, Seneca Nation of Indians, the Commonwealth of Pennsylvania (State Parks Division), the State of New York, and Cattaraugus County.

Table 3-76. Occupancy rates, campgrounds on the Allegheny National Forest, 1997-2004

Campground	Overall Occupancy 1997-2004 (%)	Weekday Occupancy 2003-2004 (%)	Weekend ¹ Occupancy 2003-2004 (%)
Buckaloons	52	30	74
Dewdrop	52	29	67
Handsome Lake	47	N/A	N/A
Hearts Content	47	7	67
Hooks Brook	40	N/A	N/A
Hopewell	58	N/A	N/A
Kiasutha	49	23	63
Minister Creek	57	N/A	N/A
Morrison	49	N/A	N/A
Pine Grove	44	N/A	N/A
Red Bridge	50	25	61
Tracy Ridge	19	N/A	N/A
Twin Lakes	51	19	65
Willow Bay	35	N/A	N/A
Beaver Meadows	19	N/A	N/A
Loleta	30	N/A	N/A
Average	44	22	66
Occupancy is only available for campgrounds which collect fees. Fee envelopes are counted to determine the # of sites occupied. Percent occupancy is calculated as follows: # of sites occupied ÷ # of sites available.			
¹ Friday and Saturday nights. Weekend vs. weekday data not available for all campgrounds.			

Dispersed recreation supply

Dispersed recreation includes such activities as driving for pleasure, horseback riding, hiking, canoeing, camping, skiing, wildlife viewing, nature study, hunting, fishing, all-terrain vehicle (ATV) and off-highway motorcycle (OHM) riding, snowmobiling and gathering forest products. The ANF dispersed recreation program includes an emphasis on dispersed camping, trails, both motorized and non-motorized, and activities that occur in the general forest area (GFA). Trails and trail use, including snowmobiling, horseback riding and ATV/OHM riding are discussed under a separate heading below.

Dispersed recreation may include the use of the road system for access to the Forest. The extensive road system and easy access to the Forest provides abundant opportunities for motorized, road-based recreation. There are a number of popular dispersed recreation areas spread across the Forest where recreation users tend to congregate. These include Longhouse Scenic Byway, Tionesta Creek and Reservoir, the Allegheny and Clarion Rivers, Allegheny Reservoir, Twin Lakes, Minister Valley, Loleta, Sugar Bay and many more. Large lakes, streams and ponds are natural attractors for Forest visitors. There are many areas on the Forest that are inventoried as Concentrated Use Areas (CUAs). These are generally unmanaged areas where concentrated use often leads to crowding during peak seasons, health and safety concerns (i.e., littering and human waste) and resource degradation (i.e., vegetative removal and trampling, soil and stream bank erosion).

Trails supply

Trail types on the ANF are currently referred to as pedestrian summer, pedestrian winter, equestrian summer, motorized winter and motorized summer. Table 3-77 displays the current miles of trail constructed on the ANF. Prior to the 1986 Forest Plan, there were 558 miles of existing trail on the Forest. From 1986 to 2004, 187 miles of trail were constructed. Table 3-78 shows snowmobile trails and connectors by road or trail type. Table 3-79 shows the miles of existing trail by trail type.

There are more motorized trails than non-motorized trails on the Forest. The total miles of non-motorized trails is 271 and the total for motorized is 474 miles. The largest trail system is the Allegheny Snowmobile Loop with 366 miles of trail.

Table 3-77. Current miles of trail, Allegheny National Forest

Type of Trail	Existing before 1986 Forest Plan	Constructed (1986 to 2004)	Total Current Miles
Pedestrian (summer and winter)	170	101	271
Equestrian	0	0	0
Motorized/winter	328	38	366
Motorized/summer	60	48	108
Total	558	187	745

Table 3-78. ANF snowmobile trails/connectors

Use	Miles
Fulltime snowmobile use	
Forest road	< 1
Forest trail	57
Unknown	1
Subtotal	58
Joint use snowmobile	
Forest road	226
Forest trail	7
Municipal	59
National Scenic Trail	< 1
Unknown	16
Total	366

Table 3-79. Existing trail by trail type, Allegheny National Forest

Trail Type	FS Miles	Non-FS Miles	Total Miles
Non-motorized			
Interpretive	16	2	18
*Pedestrian Summer–NCT Only	96	1	97
Pedestrian Summer	103	0	103
Pedestrian Winter	50	3	53
Total	265	6	271
Motorized			
Motorized Summer-ATV and OHM	108	0	108
**Motorized Winter-Snowmobile	298	68	366
Total	406	68	474

Source: Allegheny National Forest INFRA data.

*NCT = North Country National Scenic Trail

**Includes 58 miles of ATV trail open to ATV and snowmobile concurrently

Motorized trails**ATV/OHM trails**

The 1977 ORV Final Environmental Impact Statement (FEIS) was used to establish the policies and procedures to control and direct the use of off-road vehicles on the ANF and was incorporated in the management direction found in the 1986 Forest Plan. The policy provided for the establishment of five Intensive Use Areas (IUAs, see Figure 3-17) where off highway motorcycle (OHM) and ATV trail riding could occur. These areas comprised approximately 99,000 acres and include Marshburg-Stickney, Westline, Highland-Owls Nest-Twin Lakes, Bluejay-Duhring, and Grunderville-Chapman. The policy only applies to Allegheny National Forest system lands.



Figure 3-17. IUA location, ANF

1986 Forest Plan Amendment 6 (December 16, 1996) provides direction for fish habitat management and “incorporates language excluding 6,077 acres from development of motorized trails within the Westline IUA in order to meet the intent of the State Wilderness Trout Stream program for South Branch Kinzua Creek from it headwaters downstream to its confluence with Hubert Run.” This amendment provided additional Forestwide standards and guidelines as well as additional direction for MAs 3.0, 6.1, 6.2, 6.4, and 8.0.

There are currently 108 miles of ATV/OHM trails on the ANF located within four ATV trail systems, Marienville ATV/Bike Trail (37 Miles), Timberline ATV Trail (38 miles), Rocky Gap ATV Trail (20.8 miles), and Willow Creek ATV Trail (10.8 miles). The ATV summer season is from Friday before Memorial Day weekend through the last Sunday of September. A winter ATV season also occurs between the middle of December to April 1. ATV winter use is allowed on the following ATV Trails: Rocky Gap, Timberline and Marienville ATV Trail. Willow Creek and Marienville Bike Trail are closed for winter ATV use. With few exceptions ATV and snowmobile trails are separate however, some ATV trails overlap the snowmobile trail and concurrent use can be expected.

ATV trails are open to pedestrians, mountain bikes, and horse riders. Portions of each of these trails are located on classified roads that are part of the ANF road system. In some cases, the classified road may be open for public vehicle traffic as well as ATV/OHM use. In others, the road may be closed to public travel but may be used for administrative purposes in addition to the ATV/OHM use.

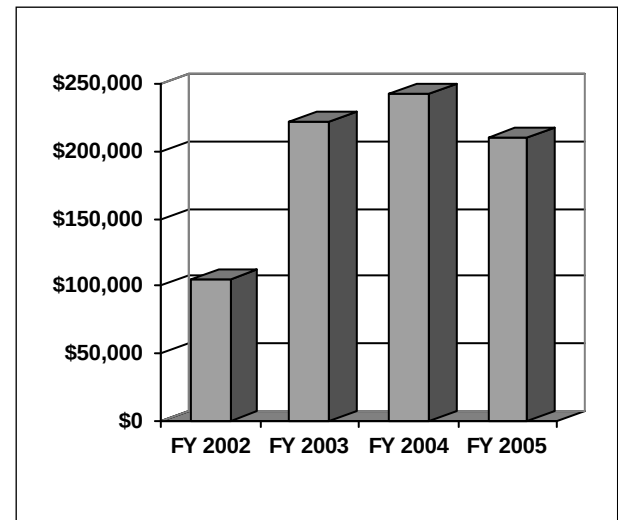
ATVs are not permitted in State Parks, but 229 miles of summer and 159 miles of winter ATV trails can be found on the Michaux, Buchanan, Bald Eagle, Sproul, Tiadaghton, Susquehannock, and Delaware State Forests (DCNR 2003). Within the ANF proclamation boundary, ATV/OHM trails are not generally available to the public on private or state game lands.

Additional trail mileage is being proposed for the Willow Creek ATV Trail located within the Marshburg-Stickney IUA. Approximately 44 miles of additional trail could be constructed as part of this project. Once the Record of Decision for the Willow Creek ATV Trail Expansion Project EIS is made, no additional trail development will occur in this IUA. This project evaluated the entire Marshburg-Stickney IUA.

The ANF began charging fees for permits (annual permit \$35) to use the ATV trails in July, 2002 (partial year use data included in graph). In 2003, a daily permit (\$10) was made available in addition to the annual permit. As Figure 3-14 demonstrates; use of the trail system has somewhat leveled off since the inception of permit sales.

Figure 3-14. ATV permit sales, 2002-2005

(Note: 2002 data is 6-month data)



Snowmobile trails

Snowmobile trails are classified as motorized winter trails. The winter season generally runs from mid December through the beginning of April, depending on snow fall. For most winters, there are less than 28 days during the winter season when there is sufficient snow for winter recreation activities (USDA FS 2003b, p. 29). Snowmobile trails are open to use by snowshoers and skiers during the winter season and by hikers and equestrians in the summer.

The snowmobile trail system provides 366 miles of trail for snowmobile riding including:

- Allegheny Snowmobile Loop (159 miles)
- Snowmobile connector trails (149 miles)
- Rocky Gap and Timberline ATV Trails (58 miles)

(Note: snowmobiles, as well as ATVs, are allowed on the Rocky Gap and Timberline trails in the winter.)

The Allegheny Snowmobile Loop and connector trails are located across the ANF with portions being co-located on Chapman State Park, State Game Lands, other State lands located in townships and municipalities and private lands. The snowmobile trail system includes 287 miles of roads and 79 miles of trail (ANF INFRA database, Table 3-78). Approximately 245 miles located on roads are designated for joint use of motor vehicles and snowmobiles. “Snowmobile connector” trails adjoin the Allegheny Snowmobile Loop at various locations and provide connections to communities, to the Rocky Gap and Timberline ATV trails and to Allegany State Park in New York. The Marienville Bike Trail is closed in the winter with parts of it designated as a snowmobile connector.

The ANF has developed and implemented a grooming and maintenance contract for snowmobile trails and connectors. The contract is reviewed by the contracting officer annually and re-issued for bid every four years. Funding for these activities are made possible through Pennsylvania snowmobile registration receipts, which are administered by the Pennsylvania Department of Conservation and Natural Resources (DCNR). Large-scale trail improvement projects are funded through appropriated dollars and gas tax funding made available through the Transportation Bill.

The Allegheny Trails Committee offers a volunteer trail host program in which snowmobile hosts offer trails information, maps, directions, and safety assistance. Volunteers maintain a trail host house in their home where snowmobilers will find trails information, maps and registration forms. There is currently one Trail Host House in the ANF proclamation boundary.

Non-motorized trails

The ANF identifies non-motorized trails in three primary categories: pedestrian summer, pedestrian winter, and equestrian summer (Table 3-79). In addition to the North Country National Scenic Trail (NCNST), there are also two National Recreation Trails on the ANF, Tracy Ridge (4.0 miles) and the Black Cherry Trail (1.4 miles). The Tracy Ridge National Recreation Trail connects to the NCNST. Cross country skiers use hiking trails, including the NCNST, as well as 50 miles of designated cross country ski trails.

Equestrian trails

The Forest currently does not have any equestrian trails that have been marked, designated or constructed for horse use; however the ANF allows open riding anywhere except where Forest Supervisor closure orders have been issued on hiking and cross country ski trails, at developed campgrounds, the National Recreation Area (Tracy Ridge only), and in Hearts Content Scenic Area. There are hundreds of miles of primitive roads, pipelines and motorized trails on the ANF that are available for horse use. Guided as well as unguided horse riding occurs. Most guided equestrian use occurs in the Hickory Creek, Kelletville and Yellowhammer areas under special use permit administered by the Forest Service. Recently, the Spring Creek EIS approved the construction of 42 miles of dedicated horse trails in the Duhring area. Implementation of this project is expected to occur over the next several years in cooperation with local riders as part of an ongoing collaborative effort.

Historically, riders follow undeveloped trail systems created over the years by frequent use or engage in cross country riding across the forest without following a trail. Areas like Kelletville, Duhring, Hickory Creek, and Scandia receive constant use seasonally, due to commercial or organized group operations. Visible impacts from user created trails to riparian areas, water, soil and wildlife habitats have been observed. Similar impacts outside of these areas are not currently evident due primarily to the random nature of cross country riding.

Bicycle trails

Bicycles can use most trails including some hiking trails, cross country ski trails, snowmobile and ATV trails as well as open and gated roads. The ANF has over 600 miles of trail where bikes are allowed, but many segments of ANF trail, even though open for bike use, do not provide a high quality experience for most bikers. True 'single track' trail for mountain biking is found on approximately 200 miles of pedestrian hiking trail. However, none of this trail was built for this purpose.

No paved or gravel rail trails for biking or hiking currently exist on the ANF. Segments of recently constructed rail trail on private land abut NFS lands and could connect the Red Bridge Campground along old railroad grades to the town of Westline. Generally, the best family oriented biking opportunities are found on gated Forest Service roads. Biking on any of the four developed ATV trails can occur at any time of year. Biking is prohibited only in the Hickory Creek Wilderness, Hearts Content and Tionesta Scenic Areas, Tionesta Natural Area, the Allegheny National Recreation Area east of the Reservoir (Tracy Ridge), Laurel Mill Cross Country Ski Trail and the propagation area of the Buzzard Swamp Wildlife Management Area.

Recreation demand

Recreation trends are developed primarily by examining participation and growth information. The first outdoor recreation participation surveys in the United States were conducted in 1960 by the Outdoor Recreation Resources Review Commission (ORRRC). Picnicking, driving for pleasure and swimming were the most popular activities with few others coming close (ORRRC, 1962). Since ORRRC, 6 additional national surveys were conducted in 1965, 1972, 1977, 1982-1983, 1994-1995 and 2000-2001. The most recent of the United States' national recreation survey (conducted in 1994-95 and in 2000-01) is the National Survey on Recreation and the Environment (NSRE).

NSRE explores outdoor recreation participation and demographics across a broad spectrum of settings and provides participation comparisons by region and state. At the national level, the survey of persons 16 years or over is applied across all ethnic groups and throughout the urban and rural areas of the United States. Also at the national level, NSRE provides information on outdoor recreation participation in four primary settings and includes an assessment of recreation participation in forest settings.

The United States has approximately 747 million acres of forest land or roughly 33 percent of the total land base. Of this, almost 640 million acres, or about 86 percent of the total forest land is available in some way for outdoor recreation. Of the public forest land, the USDA Forest Service administers the largest amount (191 million acres) or about 59 percent of the total federal forest. Consequently, America's national forests and grasslands offer the

single largest source of outdoor recreation opportunities in the United States. Over the next 50 years, demand for outdoor recreation opportunities is expected to increase from 800 million to 1.2 billion visits to the national forests per year. In addition, people are asking for a broader spectrum of benefits and services to enrich their experiences (Natural Resource Agenda 1998). The Forest Service currently receives over one-third more visitors than any other federal agency.

Outdoor recreation in forested settings is a fast-growing land use across the United States, continuing a steady trend since before the 1950s. Currently, well over 90 percent of Americans participate in at least 1 outdoor recreation activity in forest settings. Estimates of recreation days occurring in forest settings show walking for pleasure, viewing natural scenery, viewing birds, viewing flowers, viewing wildlife, day hiking, sightseeing, driving for pleasure, mountain biking and viewing a wilderness or primitive area as the most actively engaged forest-based activities in 2000-2001. On national forests alone, visitation estimates show that most use occurs in general, undeveloped forest areas (compared with use of developed sites). Generally, participation in outdoor activities continues to grow, with the greatest growth occurring among non-consumptive activities that have relatively low impact on forests. Rising demand and rising population, however, is leading to a decline in per capita acres of forest available for recreation; a trend likely to accelerate future conflicts over access and use by different interest groups (Cordell *et al.* 2004).

Regional trends

NSRE provides information on population-wide participation in forest recreation activities for different regions of the United States. The North Region ranges from Minnesota to Missouri to Delaware to Maine and includes 20 states: Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Ohio, Pennsylvania, West Virginia, Maryland, New York, New Jersey, Connecticut, Rhode Island, Delaware, New Hampshire, Maine, Vermont, and Rhode Island.

The trend in participation in activities from both the 1994-1995 and 2000 to 2001 national surveys shows that growth has occurred in all but 3 activities, sightseeing, caving and orienteering. For the same time periods, the top 10 activities by priority according to participation by activity days for the US and the North are the same and include:

1. Walking for pleasure
2. Viewing/photographing scenery
3. Viewing/photographing birds
4. Viewing/photographing flowers
5. Viewing/photographing wildlife
6. Day hiking
7. Sightseeing
8. Driving for pleasure
9. Mountain biking
10. Visiting wilderness

The top 10 activities with the most growth in order of priority are:

1. Walking for pleasure
2. Family gathering
3. Viewing/photographing wildlife
4. Day hiking
5. Picnicking
6. Visit nature centers, museums
7. Viewing/photographing birds
8. Developed camping
9. Visit historic sites
10. Driving off-road

Additional surveys conducted by the Forest Service show national forest use across the country by site type and site visit. A site visit is one occasion of any duration where 1 person enters into an area or site within a single national forest for recreation purposes. The data presented in Table 3-80 identifies estimated site visits at national forests by region. Because most of the land area in national forests is in the West, two thirds of all general forest use is in the two western regions. Likewise, for developed-site day use, two thirds of national use is in the western national forests. Forty percent of overnight developed site use, on the other hand, occurs in eastern national forests, while only 13.6 percent of use of national forest areas in the National Wilderness Preservation System is in eastern wilderness.

Forest trends

Using 2001 NVUM data for the ANF, Bowker (*personal communication*) predicted visitation to the Forest to 2025 (Figure 3-15). This analysis based visitation predictions on the current primary user base which is the 4-county area of the ANF and incorporated a number of demographic changes for Pennsylvania. Annual visits to the ANF are expected to increase from approximately 1.59 million in 2000 to 1.61 million visits in 2020. This represents a slight to moderate increase or 1.2 percent in the next 25 years.

Table 3-80. Estimated site visits in millions at national forests by region, (2000 and 2001)

Region	Day Use Developed	Overnight Developed	Designated Wilderness	General Forest Area
North	12.6	4.5	1.6	27.1
South	7.4	4.5	0.6	18.9
Rocky Mountains	35.8	9.4	7.5	55.8
Pacific	31.2	3.7	6.5	35.4
U.S. Totals	87.0	22.2	16.2	137.2

Source: USDA Forest Service (2000b). National Visitor Use Monitoring Program.

These predictions were based on the current user base. A change could occur in the future in which more users come from outside the 4-county area to visit the ANF. Marketing strategies such as PA Wilds could attract more visitors from areas farther away.

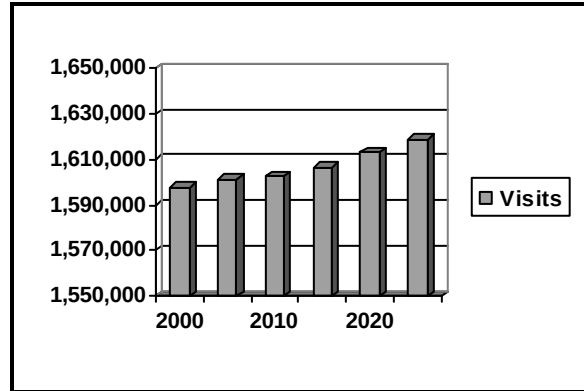


Figure 3-15. Predicted future ANF visits

Direct and indirect effects

Scope of analysis

The scope of the analysis for direct and indirect effects includes all federal land managed by the ANF. This area represents National Forest System lands where recreation resources exist, and the lands where those resources could receive impacts from management activities. The scope of the analysis for cumulative effects includes all lands within the ANF proclamation boundary including the lands administered on other ownership, both state and private, which provide recreation opportunities.

Introduction to effects

Public concern is focused on how much, what kind and where different recreation opportunities will occur on the ANF. There is division between those who desire more motorized recreational opportunities and those who desire more non-motorized opportunities. There is also concern over what kind, the amount and where trail opportunities will be provided, especially for ATV/OHM and equestrian use. To address these concerns, the ANF has provided a range of land allocations emphasizing different settings and types of recreational use among the alternatives.

The following analysis will address the effects of the alternatives on the recreation resource. General effects that do not vary greatly by alternative (e.g. developed and dispersed recreation, and certain types of trail development) are discussed below, along with general effects of timber harvesting and wildlife management on recreation. A more detailed analysis, which focuses on the following four primary concerns, is described under direct and indirect effects, and cumulative effects below.

1. Range of opportunities based on Recreation Opportunity Spectrum (ROS) Classes
2. Range of opportunities for non-motorized recreation
3. Range of opportunities for ATV/OHM trail riding
4. Range of opportunities for equestrian trail development and use

Effects common across alternatives

ROS classification

The desired ROS classes are based on the existing inventoried ROS and whether or not there is a reasonable certainty that management actions could maintain or create a desired setting. For example, in order to create a primitive or semi-primitive ROS condition from a roaded natural or rural ROS, existing roads and/or other developments would need to be decommissioned. In many cases it would be infeasible to decommission much of the road system on the ANF as there are many State, county, and township roads which provide major public access across the ANF. Also, in order to create primitive or semi-primitive ROS classes, many oil and gas roads and well development areas would need to be removed. The greatest differences between the alternatives are reflected in desired amounts of roaded natural and semi-primitive non-motorized settings.

Developed recreation

Under all alternatives, a single goal statement for recreation is to: “Provide a diverse range of high quality, sustainable recreation opportunities consistent with public demand and resource capability emphasizing locally popular recreation places and those important to the tourism industry.”

Range of opportunities for developed and dispersed recreation and trails, generally varies only as much as ROS class acreage varies by alternative. High quality developed and dispersed recreation opportunities will be offered according to the full range of ROS managed by the ANF. Under all alternatives, the ANF will use recreation facilities master planning to reduce backlog and deferred maintenance of existing facilities. Decisions about which areas will have reduced levels of service, which will be closed, and which will be scheduled for investment, will be made through facilities master planning. As demand for certain types of recreation opportunities shift, new facilities may be constructed and maintained, while others which are comparatively underused may be decommissioned or redesigned for other uses.

Public interest in development of the Allegheny Reservoir has been high. Interest has focused on the development of a motel/restaurant complex as well other facility and trail developments. Some desire wide scale development on the Reservoir, while others prefer a more undeveloped character with limited facilities and access. To address this issue, the LRMP has established a forestwide objective to complete a Reservoir plan in which the potential for additional facilities will be analyzed with input from the public.

Dispersed recreation

Dispersed camping is one of the most popular activities on the ANF. Many areas have concentrated use and there is often competition for these areas. In some concentrated use areas, dispersed camping has caused environmental conditions to deteriorate to the point of impairing sustainability of the resource. In cases where resource conditions deteriorate, restoration and/or use restrictions may occur. In some situations, parking areas, toilets, picnic tables, and fire rings may be constructed in order to protect resources and reduce visitor impacts. Decisions on how to manage concentrated use areas would be made through project level analysis.

Trails

Trail opportunities for snowmobiling, hiking, cross country skiing and biking would be provided throughout the life of the LRMP and does not vary by alternative. Trails would be constructed and maintained according to the recreation opportunity spectrum and management area prescriptions (see suitable uses section of LRMP).

Bicycle, snowmobile and ATV/OHM travel cross-country or on user developed trails would not be allowed except in an emergency that requires cross-country travel to protect public health or safety. Bicycles will be allowed, dependent on management area, on designated routes (trails/roads) not signed as closed to this use (see suitable uses section of LRMP). All trails may have single-use or multi-use designations. System trails may be restricted seasonally or under certain weather conditions as needed for safety or resource protection. Congressionally designated trails would be managed for their intended purpose; consequently the NCNST would be managed for foot travel only.

Trails on the ANF, like developed recreation, have a considerable amount of backlog maintenance needs. Given limited funding, the maintenance and/or relocation of existing trails should take priority over new trail construction. Forestwide trail management planning would be used throughout the life of the LRMP to establish demand, trail classes, permitted uses and construction, reconstruction and maintenance priorities. Opportunities to convert rails-to-trails and/or roads-to-trails would be emphasized.

For developed, dispersed, and trail recreation, the ANF will strive to maximize the impact of appropriated funds through the use of collaborative efforts and partnerships. For all recreation opportunities, tourism would be a key consideration in determining the appropriate balance of opportunities provided.

Timber management

Clearcutting and road building can create changes in the landscape, resulting in shifts from the less developed end of the ROS spectrum to a roaded modified setting. Studies have generally found that in terms of aesthetic preferences for forested landscapes, mature forest are preferred over young ones, “natural stands” over those with obvious human impact, and partial cutting techniques over clearcuts (RIBE 1989).

Commercial timber management in the LRMP is allowed in MAs 1.0, 2.1, 2.2, 3.0, and 6.1. All alternatives provide for varying amounts of land to be allocated to these management areas. Over-all, more land is allocated to these management areas in all alternatives than to other management areas which do not emphasize timber harvest.

Effects of timber harvest activities on recreation resources typically impact access (i.e., road construction or reconstruction) and scenery of the harvested area. The effects can have both positive and negative effects on the recreation experience. Direct and indirect negative effects from timber harvesting may involve increased noise and dust levels, altered landscapes (i.e., the presence of slash piles, denuded ground and tree stumps), additional roads constructed or reconstructed for timber sales, temporary closure of recreation facilities or trails due to health and safety concerns, disrupted travel routes due to any necessary road closures and conflicts and potential safety hazards associated with logging truck on main roads. Additionally, timber harvest can negatively impact those seeking a more remote, challenging

experience due to additional access provided by roads. This would be more apparent in more undeveloped and unroaded areas.

Direct and indirect positive effects can include improved access to an area for recreation activities such as pleasure driving, gathering forest products, hunting, fishing and roadside dispersed camping. Timber harvest can positively impact those seeking a more developed, roaded recreational experience associated with improved access. Additionally, timber harvest can improve habitat for some species and enhance wildlife-related recreation opportunities.

In all alternatives, the desired ROS settings and existing recreation resources will be included in site-specific analyses for timber harvest proposals. Interdisciplinary teams with public involvement will analyze proposals and the recreation related effects of timber harvest during project level planning.

Wildlife management

Wildlife management activities can have both positive and negative impacts to recreation resources. Direct and indirect negative effects of wildlife management activities may involve noise and disturbance from management activities and temporary or permanent closure of recreation facilities or trails due to wildlife concerns. Vegetative alterations such as created openings and regeneration cuts that create desired conditions for wildlife may not appear natural to some recreationists. Wildlife management also includes road closures which may negatively impact motorized recreational use and access. Conversely, road closures may benefit other recreationists by providing opportunities for hike or walk-in access to view or hunt wildlife free from the disturbance of motorized vehicles.

Direct and indirect positive effects can include enhanced opportunities for wildlife-related recreation. The number of people involved in watchable wildlife activities like bird watching and wildlife photography has exploded. Bird watching is the fastest growing outdoor pastime in the country, growing 232 percent between 1983 and 2001 based on the most recent National Survey on Recreation and the Environment. This national trend is echoed in Pennsylvania which ranks first in the nation in time spent hunting and third in time spent wildlife watching. In 2001, about 1 million Pennsylvanians hunted, more than 1.2 million fished and 3.7 million participated in non-consumptive wildlife recreation, such as viewing, feeding and photographing wildlife. In all alternatives, management for a variety of wildlife habits is emphasized, from early to late structural and within riparian corridors and watersheds across the Forest. Emphasizing a variety of habitats can improve the opportunity for a greater diversity of wildlife viewing opportunities and possibly, greater success in hunting and fishing activities.

Effects from each alternative

Range of opportunities based on (ROS)

In all alternatives, a desired ROS class is identified in each management area's desired future condition to emphasize different recreation settings and appropriate development levels associated with the assigned ROS. Even though all management areas have a desired ROS, recreation may not be the primary emphasis. For instance, Research Natural Areas and the Kane Experimental Forest have a desired ROS class of roaded natural; however, recreation use in these areas will not be emphasized in the desired future condition.

Table 3-81 illustrates the mix of desired ROS classes (based on management activities prescribed for each management area) by alternative. The desired ROS class displays the maximum level of change that an area could experience in terms of ROS over the life of the plan. It is likely that the actual on-the-ground current ROS composition will not remain constant, given the amount and magnitude of annual management and oil and gas development that has historically occurred on the ANF, especially since oil and gas development is expected to continue in areas that are already developed and additional development areas will likely occur.

Table 3-82 shows desired ROS class by management area under Alternatives B, Cm, and D.

Table 3-81. ROS category by alternative

ROS Category	2004 Forest ROS Inventory	Alternative (% Desired ROS)			
		A	B	Cm	D
Rural	21%	< 1%	2%	2%	2%
Roaded natural/Roaded Modified	75%	68%	91%	88%	83%
Semi-primitive non-motorized	4%	6%	7%	10%	15%
Semi-primitive motorized	0	26%	0	0	0

Table 3-82. Desired ROS class by management area, Alternatives B, Cm, and D

MA	Emphasis	Desired ROS
1.0	Early Structural Habitat	Roaded natural
2.1	Uneven-aged Management	Roaded natural
2.2	Late Structural Linkages	Roaded natural
3.0	Even-aged Management	Roaded natural
5.1	Wilderness	Semi-primitive non-motorized
5.2	Wilderness Study Areas	Semi-primitive non-motorized
6.1	Late Structural Habitat	Roaded natural
6.3	Buzzard Swamp Wildlife Management Area	Roaded natural
7.1	Developed Recreation Areas	Rural
7.2	Remote Recreation Areas	Semi-primitive non-motorized
7.3	Interpretive Recreation Area	Roaded natural
8.1	Recreational and Scenic Rivers	Rural Roaded natural
	Recreational Segments	
	Scenic Segments	
8.2	National Recreation Area	Semi-primitive non-motorized
8.3	Scenic Area	Roaded natural
8.4	Historic Area	Roaded natural
8.5	Research Natural Area	Roaded natural
8.6	Kane Experimental Forest	Roaded natural

Alternative A

The desired ROS classes are based on management area desired conditions and did not account for existing on-the-ground conditions as an ROS Inventory was not conducted. Under this alternative, 6 percent and 26 percent of the ANF was identified for semi-primitive non-motorized and semi-primitive motorized ROS respectively. According to the 2004 ROS Inventory, there are no semi-primitive motorized classes and the semi-primitive non-motorized ROS class comprises 4 percent of the ANF. Under Alternative A, the desired management area ROS classes will need to be amended to better reflect current on the ground conditions.

Alternative B

Table 3-81 shows a marked change between the inventoried rural ROS (21%) and the desired rural ROS (2%). The desired rural ROS class emphasizes existing highly developed recreation facilities within MA 7.1 and within MA 8.1 (Wild and Scenic River Corridor) on recreation segments of the Clarion and Allegheny Rivers. New highly developed facilities could be built in the recreational river corridor. Establishing a rural ROS for recreational river segments is consistent with the inventoried ROS as well as Forest Service direction found in the *USDA ROS Guide for River Management* which provides guidelines for using ROS in the development of LRMP direction for river areas, including designated wild and scenic rivers.

The remaining inventoried rural ROS does not contain existing highly developed recreation facilities and few new highly developed recreation facilities are anticipated during the LRMP period. In order to manage for more moderately developed facilities across the ANF, the remaining 19 percent of the inventoried rural ROS will be managed as roaded natural.

Site-specific project level planning for new high density recreation developments, such as lodges, resorts, or other similar facilities, will be evaluated to their relative consistency with the management area desired ROS prescriptions which they are located. When a deciding official accepts a project that is not consistent with the management area prescription, a determination is made as to whether the effects of the project warrant a forest plan amendment to change the management area desired ROS objective from roaded natural to rural.

Alternative B identifies the greatest amount (91%) of the ANF for a roaded natural setting and the least amount (7%) of semi-primitive non-motorized settings which are in MAs 5.1, 7.2 and 8.2. The roaded natural classification does not necessarily mean that motorized travel and access would occur. In some roaded natural areas, roads may be closed to public vehicular traffic. Although there is a roaded natural ROS in MA 8.3, 8.5, and 8.6 road-based recreation will not be emphasized. However, roaded natural settings provide opportunities primarily for dispersed motorized recreation throughout the general forest area.

Alternative Cm

Rural ROS settings are the same in Alternative Cm as they are in Alternative B. This alternative provides less roaded natural ROS (88%) and more semi-primitive non-motorized ROS class settings (10%) than Alternative B. There is an increased amount of semi-primitive non-motorized

opportunity in MA 7.2 and MA 5.2 (see congressionally designated areas section for further discussion of wilderness and national recreation area).

Alternative D

Rural ROS settings are the same in Alternative D as they are in Alternatives Cm and B. This alternative provides less roaded natural ROS (83%) and more semi-primitive ROS class settings (15%) than Alternatives B and C. Like Alternative Cm, there is an increased amount of this opportunity in MA 7.2 and MA 5.2.

Range of opportunities for non-motorized recreation

In order to provide a sustained opportunity for non-motorized recreation, the LRMP includes a new management area (MA 7.2) dedicated to remote, backcountry types of recreation in desired semi-primitive non-motorized ROS settings. MA 7.2 is considered unsuitable for timber production, and new road construction. Timber salvage may occur for restoration purposes following catastrophic events, such as wind or ice storms, or wide-scale insect and disease infestations that threaten forest health. In general, management activities and modification of the environment is limited in order to provide a sense of remoteness, solitude and closeness to nature.

These areas will also include decommissioning of roads that are not needed to provide access to private or other non-federal ownership such as State or county lands, or valid existing mineral rights. Recreation trails are emphasized and low-level recreation developments such as walk-in campsites are allowed in this management area. The use of horses and mountain bikes will be allowed on designated trails and trails may be designated as multi- or single-use. Decommissioned roads, where appropriate, will be converted or designated as trails. Existing recreation facilities such as Hearts Content Recreation Area will continue, and motorized access to existing recreation areas would be maintained. Table 3-83 displays the areas and acres of MA 7.2 by alternative. Figure 3-20 shows the location of each proposed remote recreation area.

Non-motorized recreation is also provided in MAs 5.1, 5.2, 8.2, 8.3 and 8.5. See Sections 3.4.2 and 3.4.3 for further discussion of these areas.

Table 3-83. Number of areas and acres of management area 7.2 by alternative

Alt.	# of Areas	Acres of RRA	Name of Area
A	0	0	None
B	1	4,668	Clarion River
Cm	5	9,074	Clarion River, Hearts Content, East Hickory
D	7	30,948	Clarion River, Hearts Content, East Hickory, Morrison, Lamentation Run, Longhouse, South Cornplanter

Alternative A

This alternative does not include any remote recreation areas. Under this alternative, Minister Valley, Morrison, and Lamentation Run are included in MA 6.2 with intensive timber harvesting occurring in 10 out of every 40 years. Minister Valley's intensive timber harvest period was scheduled from 1996-2006. The next harvest would occur in 2026-2036, which is beyond the time frame for the LRMP. Morrison's intensive timber harvest period is scheduled for 2006-2016. Lamentation Run was scheduled for harvest from 2016-2026.

In Alternative A, the Clarion River area is allocated as MA 6.1. Longhouse is allocated as MA 6.1 and 3.0; and South Cornplanter, Hearts Content, and East Hickory are allocated as MA 6.1.

In Alternative A, no roads are decommissioned to support remote recreation areas.

Alternative B

This alternative provides the least amount of remote recreation areas other than Alternative A. Clarion River area is the only area included as MA 7.2. Under this alternative, Minister Valley is allocated as an interpretive recreation area (MA 7.3). Under MA 7.3, trails and facilities would be highly developed for interpretive purposes. Kiosks, other outdoor interpretive displays, and highly-developed interpretive trails will be emphasized. These types of developments are intended to concentrate use and attract high numbers of visitors. In semi-primitive areas, interpretive services are informal; almost subliminal. Consequently, the MA 7.3 allocation would not be compatible with a semi-primitive, remote recreation experience.

Morrison and South Cornplanter are allocated as MA 2.2 in this alternative. Lamentation Run, Longhouse, Hearts Content, and East Hickory are allocated as MA 3.0. Longhouse is also managed as an IUA in this alternative.

The 2 miles of existing roads in the Clarion River area will not be decommissioned under this alternative as they provide access to private lands.

Alternative Cm

This Alternative provides more remote recreation areas than Alternative B but less than Alternative D. The Clarion River, Hearts Content and East Hickory areas are included. In Alternative Cm, Lamentation Run, Morrison and South Cornplanter are allocated to MA 2.2 and Longhouse is allocated to MA 3.0.

Alternative Cm also includes 2 miles of roads that will be decommissioned to perpetuate and maintain remote recreation areas as shown in Table 3-84. No municipal or non-system roads used to access private lands would be decommissioned.

Alternative D

This Alternative provides the most remote recreation areas. The Clarion River, Hearts Content, East Hickory, Morrison, Lamentation Run, Longhouse, and South Cornplanter areas will be included. Minister Valley is treated as a wilderness study area (MA 5.0) in this alternative.

In addition to allocation as MA 7.2, South Cornplanter, Hearts Content, and East Hickory will be managed as EUAs in this alternative. Equestrian use is compatible with the non-motorized recreational use intended for MA 7.2.

Alternative D includes 31 miles of roads that will be decommissioned to perpetuate and maintain remote recreation areas as shown in Table 3-84. No municipal or non-system roads used to access private lands would be decommissioned.

Road decommissioning in the proposed remote recreation areas will change current use in some areas and in other areas there will be little change. Clarion River, Morrison, and the Hearts Content/East Hickory areas will remain largely unchanged as there is little to no decommissioning needed in these areas. In Hearts Content and Morrison, motorized access to the Hearts Content Recreation Area and Rimrock will continue. The greatest change will occur in the Lamentation Run and Longhouse Areas. Roads used to access these areas by motorized vehicles for hunting or other recreation purposes will no longer exist. Hunting may continue; however, hunters will no longer be able to drive into these areas. Those preferring this level of access will be displaced to other areas on the ANF where road access within ¼ mile of most areas is available. Some hunters may prefer a more remote hunting experience in the remote recreation areas, free from the noise and disturbance of motorized vehicles.

Table 3-84. Miles of road decommissioned to support remote recreation areas by alternative

Alternative	Miles of Road *(Existing)	Miles of Road (Decommissioned)	Roads Decommissioned by Area
A	0	0	None
B	2	0	None
Cm	27	11	<u>Hearts Content/East Hickory (2 miles)</u> FR 111, 411
D	52	31	<u>Hearts Content/East Hickory (2 miles)</u> FR 111, 411 <u>Morrison (1 mile)</u> FR 510 <u>Lamentation Run (9 miles)</u> FR 210, 212, 212A, 212B, 212C, 484, 561, 561A, 579 <u>Longhouse (13 miles)</u> FR 140, 140A, 140B, 263, 263A, 263Aa, 500, 500A, 500B, 501, 501A <u>South Cornplanter (6 miles)</u> FR 298, 299

Includes Forest Service, municipal and non-system roads

Table 3-85. Acres and areas available for ATV/OHM trail development by alternative

IUA Name	Alternatives (Acres)			
	A	B	Cm	D
Marshburg/Stickney	13,996	22,921	1,699	11,839
Grunderville/Chapman	7,472	8,168	8,145	3,851
Highland/Owls Nest/Twin Lakes	17,611	19,347	12,810	0
Bluejay/Duhring	39,153	45,252	45,250	24,829
Westline	20,742	0	0	0
Longhouse	0	17,331	0	0
# of Existing IUAs	5	4	4	3
# of New IUAs	0	1	1	0
Total Acres	98,974	113,019	83,202	40,519
Estimated Trail Miles				
Existing Trail	108	108	108	70
Existing Trail Removed	0	0	0	38
Potential New Trail Construction	73	124	45	12*
Maximum Potential Trail	181	232	153	82

*As a model, this result does not take into account the potential addition of approximately 30 miles of new trail that could be constructed with the 2006 Willow Creek ATV Trail Expansion Project EIS. The difference between the model and the site specific project is that actual on-the-ground site conditions were evaluated. In this case the model estimate was less than what was actually achievable.

Range of opportunities for ATV/OHM trail riding.

New ATV/OHM trail development is provided within Intensive Use Areas (IUAs) under the LRMP. Table 3-85 displays the acres and areas that will be available for ATV/OHM trail development by alternative. The table also displays the maximum potential miles of new trail that could be constructed given optimum conditions. The maximum potential is based on resource constraints such as steepness of slope and soil type. The estimates were generated using GIS data and do not represent absolute values. On-the-ground, site-specific planning and analysis, as well as availability of funding, will determine actual miles of trail which may be constructed during the life of the plan.

Alternative A

Under Alternative A, the existing five IUAs (Marshburg/Stickney, Grunderville/Chapman, Highland/Owls Nest/Twin Lakes, Bluejay/Duhring, and Westline) will provide opportunities for ATV/OHM trail riding on 98,974 acres. All existing trail mileage (108 miles) will be retained. Approximately 73 new miles of trail will be constructed, primarily in the Marshburg/Stickney, Bluejay/Duhring, and Westline IUAs, for a total maximum potential of 181 trail miles.

Alternative B

Alternative B provides more acres and more potential trail miles than all other alternatives, including Alternative A. Under this alternative, four existing IUAs (Marshburg/Stickney, Grunderville/Chapman, Highland/Owls Nest/Twin Lakes, and Bluejay/Duhring) and one new IUA (Longhouse) will provide opportunities for ATV/OHM trail riding on 113,019 acres. In this alternative, Marshburg/Stickney is expanded to include Chestnut Ridge which is considered for wilderness study area in Alternatives Cm and D. The IUAs in this alternative will be expanded to include more acreage per IUA than Alternative A. The Westline IUA will be eliminated. All existing trail mileage (108 miles) would be retained. Approximately 124 new miles of trail could be constructed primarily in the Marshburg/Stickney, Bluejay/Duhring, and Longhouse IUAs for a total maximum potential of 232 trail miles.

Alternative Cm

Alternative Cm provides less acres and potential trail miles than Alternative A, more than Alternative D, and less than Alternative B. Under this alternative, the same IUAs as Alternative B are included except Longhouse has been eliminated. The Marshburg/Stickney, Grunderville/Chapman, Highland/Owls Nest/Twin Lakes, and Bluejay/Duhring will provide opportunities for ATV/OHM trail riding on 83,202 acres. There will be less acreage available in the Highland/Owls Nest/Twin Lakes IUA than in Alternative A, but more acreage available in the Marshburg/Stickney, Grunderville/Chapman, and Bluejay/Duhring IUAs. The Westline IUA will be eliminated. All existing trail mileage (108 miles) will be maintained. Approximately 45 new miles of trail could be constructed primarily in the Marshburg/Stickney, Bluejay/Duhring, and Longhouse IUAs for a total maximum potential of 153 trail miles.

Alternative D

Alternative D provides the least amount of acres and potential trail miles. Under this alternative, three IUAs, (Marshburg/Stickney, Grunderville/Chapman, and Bluejay/Duhring) will provide opportunities for ATV/OHM trail riding on 40,519 acres. There will be less acreage available in these IUAs than in the other alternatives. The Westline IUA will be eliminated. There will be a reduction of existing trail miles from 108 miles to 70 miles, as 38 miles of existing trail will be removed from the Highland/Owls Nest/Twin Lakes IUA. Approximately 12 new miles of trail could be constructed primarily in the Marshburg/Stickney IUA for a total maximum potential of 82 trail miles.

Under alternatives B, Cm and D, predictions for ATV trail development have been based on a resource capability model to determine the best estimate for future trail miles. Actual future trail miles may be higher or lower than the model, however substantial discrepancies are not anticipated. Future IUA-wide trail development analyses will be initiated for each of the remaining IUAs to evaluate capability based on site specific ground conditions. Based on the IUA specific analyses, trails could be constructed provided funding is available. User fees will continue into the future to help maintain the trail system.

All alternatives maintain the current trail system of 108 miles except Alternative D which would remove 38 miles of this system. Under all alternatives, a high quality ATV/OHM trail riding experience would be provided. However, some people may not be satisfied with the amount of riding which would be offered under any alternative. Furthermore, it is unknown if trail riding opportunities will be developed on state or private lands within the proclamation boundary. Consequently, the ANF is uniquely positioned as a primary provider of ATV/OHM riding opportunities in the ANF 4-county area. Those seeking additional riding opportunities may be displaced to other riding areas outside the ANF. However, since there are limited opportunities on other public and private lands, overcrowding could occur as the ANF trail system will continue to be recognized as one of the premier trail riding opportunities in the Region and a primary destination for riders.

Providing more motorized opportunities for ATV/OHMs may eliminate other opportunities for non-motorized use. This would primarily affect the Longhouse IUA which is considered for non-motorized remote recreation in Alternative D (MA 7.2) and IUA designation in Alternative B and Chestnut Ridge which is considered for wilderness study in Alternatives Cm and D and IUA designation in Alternative B.

Under Alternatives B, Cm, and D, IUAs are allocated to MAs 1.0, 2.1, 2.2, 3.0, or 6.1. Management actions within these management areas focus primarily on timber harvest or wildlife management. Standards and guidelines in the LRMP are intended to mitigate the effects of ATV/OHM trail construction and maintenance on vegetation, soils, water quality, and wildlife resources. Trail construction and use would not impact timber harvest objectives. Some closures can be anticipated due to logging activities however these are temporary and relatively short in duration. Adjacent private lands could experience increased noise levels and increased traffic as IUAs are further developed.

Based on the application of Best Management Practices as well as site specific project level planning and mitigations provided in the LRMP, direct/indirect effects from ATV/OHM trail construction activities should be minimal.

Range of opportunities for equestrian trail development and use.

Equestrian use is addressed by varying the alternatives as follows:

- Allocation of Equestrian Use Areas (EUAs). EUAs are areas dedicated for future development of equestrian trails and are located primarily where commercial operations and heavy recreational use is occurring. Within EUAs, riding will be restricted to designated trails. Open, cross country riding would be prohibited. EUAs are an overlay and are not allocated to a specific management area.
- Allocation of open (cross country), restricted or prohibited riding by management area. Outside of EUAs, open riding would be allowed cross country off of trails in some management areas, restricted to designated trails in other management areas and in some cases, all together prohibited. If prohibited, no cross country riding or riding on designated trails would be allowed.

Table 3-86 displays acres of EUA and acres for restricted, open and prohibited riding by alternative.

The EUAs overlay portions of certain management areas. **Error! Reference source not found.** identifies which management areas are overlain by EUAs (✓) and whether or not the management area is open (O), restricted (R) or prohibited (P). Not all management areas are overlain by the EUAs, nor is the entire management area allocated to an EUA. Consequently, in management areas that contain EUAs, the area outside the EUA would be managed as open, restricted, or prohibited. For example, MA 2.2 in Alternative B contains an EUA (✓) and the remaining MA 2.2 is open (O).

Alternative A

Alternative A made no clear distinction for where open riding opportunities would be allowed. In alternative A, appropriate trail construction types by management area were provided. Equestrian trail construction was appropriate in MAs 2.0, 3.0, 6.1, 6.2, 6.4, and 7.0, however open riding has been allowed in these areas. Since alternative A only addressed the appropriateness of trail construction types, the assumption with Alternative A is that open riding was also allowed in all management areas regardless of emphasis placed on trail construction types. Therefore, this alternative allows open riding in all management areas. Subsequent Forest Supervisor closure orders issued during the life of the 1986 Forest Plan prohibits equestrian use on hiking and cross country ski trails, at developed campgrounds, the National Recreation Area (Tracy Ridge only), and in Hearts Content Scenic Area. This alternative does not provide EUAs.

Alternative B

This alternative restricts riding to designated trails in EUAs (11,000 acres) and management areas (MAs 5.1, 5.2, 6.3, 7.2, and 7.3) and prohibits riding in MAs 8.3, 8.5 and 8.6. Over all, this alternative provides more opportunities for riding on designated trails than Alternative A and less open riding.

Table 3-86. Allocation of EUAs by alternative

Allocation	Alternatives (*Acres)			
	A	B	Cm	D
EUA (restricted to designated trails only)	0	11,000	11,000	50,000
By Management Area Outside of EUAs				
Restricted Riding	0	18,000	31,000	0
Open Riding	506,000	470,000	457,000	0
Prohibited Riding	0	7,000	7,000	456,000

*NFS land acres only. Numbers rounded to nearest 1,000.

Table 3-87. EUA overlay and riding restrictions by management area

MA	Emphasis	Open (O), Restricted (R), Prohibited (P) EUA also in MA (✓)			
		Alternatives			
		A	B	Cm	D
1.0	Early Structural Habitat	O	O	O	P
2.0/2.1	Uneven-aged Management	O	O	O	P (✓)
2.2	Late Structural Linkages	*	O (✓)	O (✓)	P (✓)
3.0	Even-aged Management	O	O (✓)	O (✓)	P (✓)
5.1/5.2	Wilderness/Wilderness Study Areas	O	R (✓)	R (✓)	P (✓)
6.1	Late Structural Habitat	O	O (✓)	O (✓)	P
6.2	10/30 Management	O	*	*	*
6.3	Buzzard Swamp Wildlife Management Area	O	R	R	P
7.0/7.1	Developed Recreation Areas	O	O	O	P
7.2	Remote Recreation Areas	*	R	R	P (✓)
7.3	Interpretive Recreation Area	*	R	R	P
8.1	Recreational and Scenic Rivers	*	O	O	P (✓)
6.4/8.2	National Recreation Area	O	O	O	P (✓)
8.0/8.3	Scenic Area	O	P	P	P (✓)
8.4	Historic Area	*	O	O	P
8.0/8.5	Research Natural Area (RNA)	O	P	P	P
8.6	Kane Experimental Forest (KEF)	O	P	P	P

* Management Area not present in Alternative A or in LRMP (Alternatives B, Cm and D).

(✓) EUA also in management area.

In Alternative B, the EUA overlays the Bluejay-Duhring IUA. In the co-designated EUA/IUA areas, both equestrian trails and ATV/OHM trails will be constructed and maintained. ATV/OHMs will not be allowed on equestrian trails, however, equestrians may be allowed on ATV/OHM trails even though it is generally recognized that horses and ATVs are incompatible. Trails will be designed and constructed to intersect perpendicular to each other in order to separate these two primary uses. Equestrians and horses may be directly or indirectly affected by ATV/OHM use within the EUA/IUA areas. Direct and indirect negative effects may involve noise and disturbance to equestrians from ATV/OHM.

Alternative Cm

Alternative Cm restricts and prohibits riding in the same management areas and provides the same EUAs as Alternative B. This Alternative provides more riding on designated trails and less open riding than alternatives A and B because of variations in management area allocations that occur between the alternatives. Alternative Cm also contains the same EUA/IUA overlay as discussed in Alternative B.

Alternative D

Alternative D would eliminate all open riding on the Forest and restrict riding to designated trails within EUAs. All management areas except those portions of MA 2.1, 2.2, 3.0, 5.1, 5.2, 6.1, 7.2, 8.1, 8.2, and 8.3 which contain the EUAs would be prohibited. This Alternative provides less riding on designated trails than Alternatives B and Cm. Alternative D provides more EUA/IUA overlap than Alternatives B and Cm, with roughly 43 percent EUA and 57 percent IUA. The same management approach as discussed in Alternatives B and Cm of the IUA/EUA apply to Alternative D.

Under Alternatives B, Cm, and D, a transitional plan will be established to manage horse use until areas or trails can be made available. The transitional plan will have the greatest effect on EUAs where the network of existing user created trails will need to be evaluated and either accepted into the National Forest Trail System or abandoned and logical relocations established and constructed. A direct result of designating a trail system could lead to increased use once trails are established and advertisement of the ANF as an equestrian destination begins. Given an expected increase in use, cross country riding areas will be closely monitored to minimize long-term impacts that may develop once favorite areas are found and repeatedly ridden.

In Alternatives B, Cm, and D some equestrian use is restricted to designated trails either through variation in management area or EUA allocation. Alternative D restricts the most followed by Cm and B respectively. However, there is currently no supply of designated equestrian trails on the ANF. Until trails are designated, the EUAs and management areas will be available for open riding unless specifically closed due to resource concerns.

Management areas restrict riding to designated trails based on the desired condition and management area prescriptions (suitable uses). The EUAs in the alternatives restrict riding to designated trails primarily because these areas are currently receiving relatively high use from

equestrians, and there are known resource impacts to water quality, vegetation, wildlife and/or soils. In the 2004 Spring Creek Environmental Impact Statement (Allegheny National Forest, Marienville Ranger District), unmanaged user-created equestrian trails in the Bluejay/Duhring EUA/IUA (part of the Spring Creek Project Area) were documented along with significant impacts to riparian areas, water, soil and wildlife habitats. To lessen the impacts of these user created trails, a decision was made to design, construct and designate 42 miles of equestrian trail (Spring Creek FEIS and ROD). Also in this decision, the remaining project area was to be closed to open riding. The Spring Creek FEIS and ROD is compatible with the EUA concept in the alternatives. Implementation of the Spring Creek trails will provide designated equestrian trails for the Bluejay/Duhring EUA area.

Project level planning, along with availability of funds, will determine where and when site specific equestrian trails would be constructed in either management areas or EUAs. Where unacceptable resource damage occurs in open riding areas due to commercial or recreational use, the area may be closed, restricted to trail use only or designated as a future Equestrian Use Area (EUA). Project proposals for new EUAs or closure of open riding areas will be evaluated to their relative consistency with the LRMP. When a deciding official accepts a project that is not consistent with the plan, a determination is made as to whether the effects of the project warrant a forest plan amendment. The full effects of either of these outcomes will be analyzed.

Existing trails (other than nationally designated trails) may be designated for equestrian use provided the trail is constructed or reconstructed to sustain equestrian trail use. Roads and trails may be open to horse use unless specifically signed closed. Many roads and trails are likely appropriate for this use however, site specific trail planning will establish trail classes, permitted uses, and construction, reconstruction and maintenance priorities. Trail planning is scheduled to occur throughout the life of the plan.

Cumulative effects

For the evaluation of cumulative effects, this analysis addresses how the alternatives and/or other management actions may impact recreation settings and experience in the future. Recreation settings were chosen because they provide the back drop for all recreation activities to occur. Since recreation settings occur across all lands within the ANF, the analysis area includes private, State, and Federal lands within the proclamation boundary

The timeframe for past and present cumulative effects is from 1986 to the end of the revised planning cycle (15 years or 2020). All recreation uses such as non-motorized, semi-primitive recreation opportunities, developed recreation, dispersed recreation and other general trail uses are addressed in the context of recreation settings.

Past and present actions

Environmental modification caused by oil and gas development is the primary factor, both presently and in the past, that influences all settings, especially semi-primitive recreation settings. Since 1986, 4,493 new wells have been drilled on the ANF. To maximize production, close well spacings of 400 to 500 feet were frequently utilized. This equates to approximately one well drilled per every 5 acres. In addition to

the well pads, land is also cleared for access roads to each well. For each new well drilled, approximately 0.3 acres are cleared for each well pad and one acre is cleared for roads (0.25 mile x 35' clearing width). At present, an estimated 8,000 oil and gas wells are in production. Due to a progressive rate of oil and gas development, semi-primitive lands have become relatively scarce. The combined effects of oil and gas development, presence of roads and private land ownership patterns further reduce semi-primitive opportunities. In general, large contiguous blocks 2,500 acres or greater are needed to meet national semi-primitive criteria. The presence and distribution of private lands and permanent roads are indicative of rural settings which cover roughly 106,000 acres or 12 percent of the ANF. In rural settings, the sites and sounds of human activity are commonly present.

Lands that have been heavily modified by oil and gas development have a somewhat “industrial” appearance which has been inventoried as roaded modified (63,320 acres). These settings would have been present in 1986 but to a lesser degree than in 2005. Again, as oil and gas development progressed across the landscape, these settings increased. Roaded modified settings are used in the LRMP to help describe these heavily modified areas to potential recreation users so that they know what kind of setting and experience to expect when making choices about where to recreate.

There is a general lack of “remoteness” on the ANF due to land ownership patterns and permanent roads that fragment the ANF into discontinuous blocks throughout the proclamation boundary. Of the 740,643 acres of land within the ANF proclamation boundary, approximately 234,000 acres, or 32 percent, is included in private lands. On private lands, inventoried recreation settings include primarily roaded natural (105,000 acres), followed by rural (100,000 acres) and roaded modified (29,000).

Future actions

Impacts to recreation settings from oil and gas development are potentially the greatest in areas where little to no evidence of such activities previously exists. Applied to any alternative, management areas 5.1, 5.2, 7.2, 7.3, 8.2, 8.3, and 8.5 currently have relatively limited oil and gas development especially when compared to the rest of the Forest. The future forecast of development activity could range from the historic trend of 225 wells drilled per year (low scenario) to 800 wells per year (high scenario). The most likely scenario is 512 wells per year. This scenario is a 50 percent increase from the current historic trend. A transformation of settings and opportunities will likely occur roughly proportional to oil and gas development. Consequently, more roaded modified settings and less roaded natural and semi-primitive settings could be expected in the future. High intensity oil and gas development in areas where little to no drilling has occurred will adversely affect recreation experiences, and in particular, remote, semi-primitive recreation experiences. As a result, those seeking a more remote and less developed recreation experience could be displaced to other State or National Forests where remote, semi-primitive settings and experiences are more readily available. One way the ANF could mitigate this effect is to acquire subsurface rights. The LRMP establishes a objective in 5400 Land Ownership to “Work with partners to acquire subsurface ownership of lands in MAs 5.1, 5.2, 7.1, 7.2, 8.1, 8.3, 8.4 and 8.5 and withdraw these lands from future mineral development.

Development activities on adjacent private, state and/or federal lands within the proclamation boundary may also affect recreation experiences; however the settings on the ANF are not anticipated to change.

The recreation settings on the Forest were mapped according to the ROS National Mapping protocol and included all lands within the proclamation boundary. A primary factor influencing settings is the amount and placement of private lands and permanent roads. This is especially true for semi-primitive settings which are located ½ to 3 miles from roads open to motorized use (ROS National Mapping Protocol). Over the life of the LRMP, no substantial increase or decrease in private, state or federal lands or the permanent state, county, township or federal road system is anticipated, therefore, the settings within the ANF are expected to remain relatively constant with a majority in the roaded natural ROS classification. However, development activities associated with farming, logging and residential development create noise and disturbance that can influence the quality of recreation experiences. The sights and sounds of human presence may diminish some users experience while others may not be affected at all. Impacts to recreationists occur when the sights and sounds of development interferes with the achievement of a desired recreation experience. Those seeking nature based experiences free from the influence of human sights and sounds may be most affected by activities on adjacent lands.

Another problem facing recreation is the widespread distribution of insects and disease that have killed trees in large portions of the ANF. The settings and scenery which are so important to recreation are affected by the loss of vegetation. Where large killing fronts occur, it may be difficult to maintain or achieve desired conditions for recreation resources.

Under all alternatives, management activities are designed to provide a range of recreation settings. Recreation facilities and trails would be designed and constructed based on ROS which determines the appropriate level of development, access, site modification, and other managerial controls. Based on the ROS desired conditions in the LRMP, the cumulative effects from federal actions to recreation settings could result in more roaded natural and less semi-primitive depending on which alternative is chosen. Management of Chestnut Ridge and Minister Valley under a MA 3.0 prescription in Alternative B is where the primary reduction in semi-primitive would occur.

Under all alternatives, a range of recreation settings and experiences are provided that include motorized and non-motorized recreation opportunities, high density developed recreation opportunities at amenity based campgrounds, and a wide range of winter and summer trail and dispersed recreation opportunities. With additional marketing and an expanding national population, it is likely that recreation use on the ANF may increase. All the alternatives provide mostly roaded natural settings in which a range of developed, dispersed and trail opportunities will be provided. Additional opportunities will be expanded where feasible, dependent on budget, shifting demands and resource concerns. No negative impacts are expected to private or other government providers of recreation opportunities or services.

3.4.2 Congressionally Designated Areas

The ANF contains three types of congressionally designated areas which include Wilderness, National Recreation

This section has been updated to reflect modifications to the DEIS Alternative C.

Area and National Wild and Scenic Rivers. The following sections describe the affected environment and direct, indirect and cumulative effects for these three areas.

Wilderness/roadless

Affected environment

The Wilderness Act of 1964 defined a wilderness as an area of undeveloped federal land designated by Congress that has the following characteristics:

- It is affected primarily by the forces of nature, where people are visitors who do not remain
- It may contain ecological, geological, or other features of scientific, educational, scenic, or historic value
- It possesses outstanding opportunities for solitude or a primitive and unconfined type of recreation
- It is an area large enough so that continued use will not change its unspoiled natural condition

Wilderness is found in all but six states: Connecticut, Delaware, Iowa, Kansas, Maryland, and Rhode Island. Currently, the National Wilderness Preservation System contains 106,498,016 acres. This represents 4.7 percent of the entire United States, an area slightly larger than the state of California. Roughly 54 percent of America's Wilderness is found in Alaska. The remaining wilderness is found in a wide variety of ecosystems throughout the country including swamps in the Southeast, snowcapped peaks in the Rocky Mountains, hardwood forests in the Northeast, and deserts in the Southwest. More than half of these diverse Wilderness areas are within a day's drive of America's largest cities.

Since passage of the Wilderness Act in 1964, the National Wilderness Preservation System has grown from about 9 million acres to 106 million acres. In the U.S., the National Park Service manages 43 million acres (45%), the US Fish and Wildlife Service 21 million acres (20%), the USDA FS 35 million acres (29%), and the Bureau of Land Management 5 million acres (5%). The FS manages an estimated 63 percent of the Wilderness in the lower 48 states. One acre in six of the NFS is now in the National Wilderness Preservation System. Wilderness and the most remote recreational opportunities are heavily concentrated in the Western United States. Due to fewer people and more wild lands, the effective availability of Wilderness and the majority of remote recreational opportunities are about 15 times greater in the West than the East.

The demand for wilderness, however, goes beyond recreation. Other values include long-term environmental monitoring, scenic backdrops for tourism, watershed protection, and maintenance of biological diversity. Many people who do not regularly visit primitive, roadless or designated Wilderness areas still value protection of such areas to maintain the opportunity for visits in the future (option value). People also gain benefits simply from knowing that natural areas exist (existence values) and that their protection today sustains them for future

generations (bequest value). The option, existence, and bequest values, when combined are known as passive use values (Loomis 2000).

Several studies have shown the importance and value people place on these passive use benefits of wilderness (Cordell *et al.* 1999). These values or needs are reflected in the National Survey on Recreation and the Environment (NSRE 2001) finding that 69.8 percent of those surveyed agreed or strongly agreed to the question, “How do you feel about designating more federal lands in your state as wilderness?” Over 96 percent agreed or strongly agreed with the statement, “I enjoy knowing that future generations will be able to visit and experience wilderness areas.”

Wilderness designation, with its associated benefits and limitations, engenders passionate debate in the American public. On the ANF, the public has been emphatically divided on this subject. While some desire more wildernesses, others do not want any additional wilderness designations. Various advocacy groups and members of the public as well as state and local government have developed positions on this issue. Due to the division of opinions on this subject, a thorough inventory and evaluation process for additional wilderness is critically important.

Roadless area inventory and wilderness evaluation

The evaluation of potential wilderness study areas consists of two steps. The first step is to identify and inventory all roadless, undeveloped areas and the second step is to evaluate the inventoried roadless areas from the first step for consideration as congressionally designated wilderness study areas. The evaluation considers, in detail, the potential addition of roadless areas to the National Wilderness Preservation System to determine the mix of land and resource uses that best meet public needs (see Appendix C).

Roadless inventory

In 1972 the FS initiated a review of NFS roadless areas known as the Roadless Area Review and Evaluation (RARE) to determine their suitability for inclusion in the National Wilderness Preservation System (NWPS). No areas were identified on the ANF in this review. The second review process conducted in 1979 (RARE II), adjusted the criteria used in the first RARE and resulted in a nationwide inventory of roadless areas that included 34,358 acres of ANF land. Since that time, no other roadless areas have been identified in the 1986 Forest Plan or in any other unit plans. These RARE II areas included:

Hickory Creek	9,337 acres
Allegheny Islands	368 acres
Tracy Ridge	9,188 acres
Cornplanter	3,012 acres
Clarion River	3,440 acres
Allegheny Front	7,424 acres
Minister Valley	1,375 acres
Hearts Content	200 acres
Verbeck Island	<u>14 acres</u>
	34,358 acres

In the years following the RARE II review, Congress designated some RARE II areas as wilderness, some as other special area designations and some areas did not receive any special designations. Congress, under the Pennsylvania Wilderness Act of 1984 designated RARE II acres on the ANF as Wilderness and National Recreation Area. These areas include Hickory Creek and Allegheny Islands Wilderness and Tracy Ridge, Cornplanter, and Allegheny Front as National Recreation Area.

The ANF completed the Roadless Area Inventory required for forest plan revision to determine if any roadless, non-wilderness lands on the ANF should be considered for recommendation as potential wilderness study areas. Direction for this inventory is found in the following: Regulatory (36 CFR 219.7); FS Handbook (FSH 1909.12); and Regional Guidance (1920/2320 August 13, 1997).

The inventory results are provided in Table 3-88 in which three areas are identified. Further discussion of the roadless area inventory and evaluation of these areas can be found in Appendix C.

Wilderness evaluation

The second phase in assessing the potential wilderness resource is the roadless area evaluation. The Forest assessed each Forest Plan Revised Roadless Area according to the evaluation criteria found in FSH 1909.12, Chapter 7, Section 7.2. The evaluation process addresses the capability, availability and need for wilderness.

The Forest Supervisor in October of 2005 included Allegheny Front for further consideration as wilderness in the alternatives. It should be noted that Allegheny Front (6,742 acres) received further consideration as potential wilderness study even though it was not included in the Revised Roadless Area Inventory. This decision is documented in Appendix C. The roadless area evaluations for Tracy Ridge, Chestnut Ridge, Minister Valley and Allegheny Front can all be found in Appendix C of the EIS.

Wilderness study area recommendation

Wilderness Study Areas are those roadless areas the ANF is recommending to Congress as potential wilderness. The ANF included all three inventoried roadless areas as potential Wilderness Study Areas and the Allegheny Front RARE II area in various combinations in the alternatives. It is important to note, however, that a result of forest plan revision will not be the designation of wilderness. Congress has the only authority to create wilderness areas. A possible result of forest plan revision is to recommend as Wilderness Study Areas to Congress none, one or all of the areas being evaluated. Wilderness Study Areas will be managed to protect wilderness characteristics pending legislation as to their designation.

Table 3-88. Forest plan revised roadless areas

Area Name	Acres
Tracy Ridge	9,033
Minister Valley	9,145
Chestnut Ridge	5,063
Total Acres	23,146

Existing condition

The existing condition of the resource involves the condition of designated ANF Wilderness, as well as the condition of the areas that recommended as Wilderness Study Areas in the alternatives.

Wilderness areas

There are 9,031 acres of wilderness on the ANF contained within two congressionally designated areas, Hickory Creek Wilderness and the Allegheny Islands Wilderness. These wilderness areas comprise approximately 2 percent of the total ANF land base. These areas are within a day's drive of several major metropolitan areas including Cleveland, Buffalo and Pittsburgh. The next closest location for wilderness opportunities is found on the Monongahela National Forest in West Virginia with 89,166 acres of wilderness and the Green Mountain National Forest in Vermont with 59,421 acres of wilderness. Although relatively small, the ANF wilderness areas are an important component of the Forest's recreational appeal, especially for dispersed camping and trail based activities in backcountry and island settings.

The best estimates of wilderness visitor use have been collected through the National Visitor Use Monitoring Survey (NVUM). From October 2000 through September 2001, the ANF participated in its first NVUM survey. According to this report, there were 1,411,875 visits to the ANF and of this, 36,815 visits or 2.6 percent to Wilderness. The average length of stay in Wilderness on the ANF was 15.5 hours.

Twenty-five percent of the exiting recreation visitors interviewed were asked about the types of constructed facilities and special designated areas they used during their visit. The most used facilities and areas were: forest roads, non-motorized trails, scenic byways, developed fishing sites, and designated Wilderness.

Both the Hickory Creek Wilderness and Allegheny Islands Wilderness areas have been withdrawn of all leasing authority for federal minerals and private subsurface rights have been acquired. Use of these existing wilderness areas has focused on recreation activities. Primary recreational activities in Hickory Creek Wilderness include hiking the 12.1 mile Hickory Creek Trail, viewing wildlife and scenery, dispersed camping, backpacking, hunting and fishing the headwaters and tributaries of East and Middle Hickory Creek for brook trout. The headwaters and tributaries of East and Middle Hickory Creek are a prime scenic attraction of the Wilderness. Hickory Creek Trail is maintained to a primitive standard in order to protect the natural appearance and scenic integrity of the Wilderness. Hickory Creek Wilderness is surrounded by roads with primary access provided at the picnic area within Hearts Content Scenic Area. Other access points are along State Highway 3005 and Forest Route 119. There are no developed campgrounds or other facilities within the Wilderness.

The Allegheny Islands Wilderness Area is composed of:

Crull's Island	96 acres
Thompson's Island	67 acres
R. Thompson's Island	30 acres
Courson Island	62 acres
King Island	36 acres
Baker Island	67 acres
No Name Island	10 acres

The Islands are along the Allegheny Wild and Scenic River between Kinzua Dam and Tionesta. The Islands are popular for dispersed camping, exploration and viewing scenery and wildlife. Access is by canoe or motor boat. There are no developed trails or other facilities on the Islands. All recreational activities including maintenance of trails and dispersed campsites must be non-motorized in wilderness. Activities such as hiking, hunting, fishing, camping and cross country skiing are allowed. Motorized and mechanized equipment and vehicles, and commercial enterprises except for outfitter and guides under permit are prohibited in wilderness areas.

Management activities have focused primarily on trail construction and maintenance that meet wilderness standards, interpretation and education, law enforcement and boundary marking and maintenance. Allowed management activities include search and rescue, research (with restrictions), fire control, and access to existing in-holdings and private rights. Timber harvest, creation or maintenance of wildlife and viewpoint openings by motorized methods and maintenance of trails with motorized equipment such as chainsaws are examples of prohibited wilderness management activities.

Issues currently facing the ANF wilderness areas include appropriate levels of trail maintenance for brushing, tread repair, blazing and signage, trespass, illegal motorized use, over crowding, outfitter/guides, invasive species, impacts of new technology such as cell phones, GPS, and geo-caching, and the lack of quality baseline data and methods to monitor and measure changes to wilderness character. Impacts from user developed trails and dispersed camp sites are also a concern. In addition, limited funding for wilderness programs and staffing has affected management activities including monitoring and wilderness education programs.

Inventoried roadless areas

The current condition of the proposed Wilderness Study Areas is derived from the roadless area evaluation process where these areas were assessed in detail by an interdisciplinary team of resource specialists. The roadless area inventory process and the full roadless evaluations are documented in Appendix C.

The roadless area inventory produced three roadless areas for evaluation. These three areas are grouped in various combinations to become recommended Wilderness Study Areas in the

alternatives. A varying degree of management activity has taken place in these proposed Wilderness Study Areas. They include Tracy Ridge, Chestnut Ridge, and Minister Valley.

Tracy Ridge (9,033 acres)

Tracy Ridge is characterized by steep rugged terrain leading to high plateau uplands set in a wooded landscape intermixed with streams and continuous forest cover. There are approximately 31 miles of hiking trails which include the North Country National Scenic Trail (10.7 miles) and the Tracy Ridge/Johnny Cake loop trail system (20 miles). There are a number of abandoned roads and facilities from early oil and gas and logging production; i.e., old roads, railroad grades, pipelines, oil well sites, power houses, road lines and cleared rights-of-way, which have primarily reverted to natural forest conditions. Many of the abandoned roads were incorporated into the trail system. There are also two boat-to campgrounds within Tracy Ridge, Handsome Lake and Hopewell, which are located along the Allegheny Reservoir.

Chestnut Ridge (5,063 acres)

Chestnut Ridge is located to the east of Tracy Ridge. They are separated from one another by State Route 321. Chestnut Ridge and Tracy Ridge are similar in character with steep rugged terrain and natural appearing, wooded landscapes. There are no improved roads within Chestnut Ridge or any trails or developed recreation facilities.

Minister Valley (9,145 acres)

Minister Valley exhibits a wide range of topography, site conditions, soil types, drainage systems and vegetation. The primary use of the area has been for recreation, wildlife and timber management. It is a popular recreation destination, especially with local residents and draws high numbers of visitors on weekends throughout the spring, summer and fall seasons. There are approximately 13 miles of hiking trail in Minister Valley: 7.3 miles on the Minister Creek Loop Trail and 5.6 miles on the North Country National Scenic Trail (NCNST). Day hiking is most popular with visitors along the Minister Creek Loop Trail. The NCNST and Minister Loop Trail are interconnected providing both day hiking and long distance hiking opportunities. Additional hiking occurs on several low level roads located within the area. Mountain biking and occasional equestrian use also occurs along the roads. There are approximately 4 miles of the 366 mile Allegheny Snowmobile Loop Trail located adjacent and/or within the area.

Direct and indirect effects

Scope of analysis

The scope of the analysis for direct and indirect effects includes all federal land managed by the ANF. This area represents NFS lands where potential wilderness designation areas exist, and the lands that could receive impacts from wilderness designation.

The scope of the analysis for cumulative effects includes all lands administered within the ANF including private, state and federal lands. Because wilderness is a unique resource on a national and regional scale, cumulative

effects will also include lands which provide wilderness opportunities within a regional proximity to the ANF. Proximity to the ANF is defined as the Mid-Atlantic Region and Ohio. The Mid-Atlantic Region as defined here includes Delaware, Maryland, New Jersey, New York, Pennsylvania, and West Virginia. This area represents both state and federal lands which provide wilderness opportunities.

Introduction to effects

Public concern is focused on how much designated wilderness the ANF needs to provide. The public is divided on the subject of wilderness; while some desire more wilderness, others do not want additional wilderness designated. To address this issue the ANF has four areas which are proposed as Wilderness Study Areas in the alternatives. There is concern over how these areas will be managed if they are not managed as wilderness. Another topic of public concern is over RARE II Inventoried Roadless Areas and how they will be managed under each alternative.

The following analysis will address the effects of the alternatives on the wilderness resource. The analysis will focus on the following three primary concerns which help measure the consequences (effects) of the proposed actions of the alternatives.

1. Number of areas and acres recommended for Wilderness Study Area.
2. Management of potential Wilderness Study Areas if not recommended as wilderness.
3. Management of RARE II areas.

Effects common to all alternatives

In all alternatives, proposed wilderness study areas will be managed to protect wilderness values pending legislation as to their classification. In all alternatives, Hickory Creek and Allegheny Islands are included in MA 5.1 while Wilderness Study Areas are included in MA 5.2. For the purposes of determining the effects of the alternatives on the wilderness resource in this analysis, the proposed Wilderness Study Areas are examined as if they are managed as wilderness areas.

Effects from each alternative

Number of areas and acres recommended for wilderness study area.

Alternative A

Alternative A contains 9,031 acres of designated wilderness and no acres of proposed Wilderness Study Area. Alternative A represents the current management alternative for wilderness with no potential for additional Wilderness Study Areas. Under this alternative, 2 percent of the ANF is managed as wilderness.

Alternative B

Same as Alternative A

Alternative Cm

Alternative Cm contains 9,031 acres of designated wilderness and 12,379 acres of proposed Wilderness Study Area. Alternative Cm includes Minister Valley (7,316 acres) and Chestnut

Ridge (5,063 acres) as proposed wilderness study areas. Under this alternative, approximately 4 percent of the ANF is managed as wilderness.

Alternative D

Alternative D adds the most wildernesses to the ANF. It contains 9,031 acres of designated wilderness and 29,983 acres of proposed Wilderness Study Area. Alternative D includes Tracy Ridge (9,033 acres), Chestnut Ridge (5,063 acres), Minister Valley (9,145 acres) and Allegheny Front (6,742 acres) as proposed wilderness study areas. Under this alternative, 8 percent of the ANF is managed as wilderness.

Management of potential wilderness study areas if not recommended as wilderness.

The effects analysis will disclose how these areas will be managed if not chosen as wilderness. Table 3-90 displays the management area emphasis for each of the potential Wilderness Study Areas (WSA) by alternative and whether or not the areas are suitable for new road construction and timber production. Activities associated with road construction and timber harvest are the primary activities that will affect the roadless character of the areas.

Table 3-89. Comparison of wilderness study areas by alternative

Alternative	Designated Wilderness (Acres)	Wilderness Study Areas	Acres	% of ANF as Wilderness
A	9,031	None	0	2%
B	9,031	None	0	2%
Cm	9,031	Minister Valley, Chestnut Ridge	12,379	4%
D	9,031	Tracy Ridge, Chestnut Ridge, Allegheny Front, Minister Valley	29,981	8%

Table 3-90. Management area allocation by alternative for potential WSA

WSA	Acres	Management Area				Suitable for Timber Production				Suitable for New Road Construction			
		Alternatives				Alternatives				Alternatives			
		A	B	Cm	D	A	B	Cm	D	A	B	Cm	D
Tracy Ridge	9,033	6.4	8.2	5.2	5.2	No	No	No	No	No	No	No	No
Allegheny Front	6,742	6.4	8.2	8.2	5.2	No	No	No	No	No	No	No	No
Minister Valley	9,145	6.2 3.0 6.1	3.0 7.3 2.2	3.0 5.2	5.2	Yes Yes Yes	Yes No Yes	Yes No	No	Yes Yes No	Yes No No	Yes No	No
Chestnut Ridge	5,063	6.1	3.0	5.2	5.2	Yes	Yes	No	No	Yes	Yes	No	No

Tracy Ridge and Allegheny Front

Under all alternatives, Tracy Ridge and Allegheny Front will not be suitable for timber production or new road construction. These areas will be managed as either Wilderness Study areas or National Recreation Area in the alternatives.

Minister Valley**Alternative A**

Minister Valley receives three management area prescriptions: MA 6.2 (70%), MA 3.0 (20%) and MA 6.1 (10%). Minister Valley is suitable for timber production and new road construction in all of these management areas.

Alternative B

Minister Valley receives a MA 3.0 prescription (55%), MA 7.3 prescription (35%), and a MA 2.2 prescription (10%). The majority of this area will be managed for timber production under the MA 3.0 prescription. Timber production is also allowed in MA 2.2 but not in MA 7.3. New road construction will be allowed in MA 3.0 but not in MA 7.3 and MA 2.2.

Alternative Cm

Minister Valley receives a MA 3.0 prescription (20%) and a MA 5.2 Wilderness Study Area prescription (80%) in Alternative Cm. New road construction and timber production will be allowed in MA 3.0 but not in MA 5.2.

Alternative D

Minister Valley receives a MA 5.2 Wilderness Study Area prescription. Neither timber production nor new road construction will be allowed.

Chestnut Ridge**Alternative A**

Chestnut Ridge receives a MA 6.1 prescription. Chestnut Ridge is suitable for timber production and road construction in MA 6.1.

Alternative B

Chestnut Ridge receives a MA 3.0 prescription. The area will be managed for timber production under the MA 3.0 prescription. New road construction will also be allowed in MA 3.0. Chestnut Ridge is also included in the Intensive Use Area for ATV/OHM trail development in this alternative.

Alternatives Cm and D

Chestnut Ridge receives a MA 5.2 Wilderness Study Area prescription. Neither timber production nor new road construction will be allowed.

Management of RARE II areas

For all alternatives, the RARE II areas will be managed according to the Management Area in which they are located. Table 3-91 displays the management area emphasis for each of the RARE II areas by alternative and whether or not the areas are suitable for new road construction and timber production. Activities associated with road construction and timber harvest are the primary activities that will affect the roadless character of the areas.

Under all alternatives, Tracy Ridge, Cornplanter, Allegheny Front and Hearts Content will not be suitable for timber production or new road construction. Under Alternatives A and B, Minister Valley is suitable for timber production but not in any other alternatives. A portion of Minister Valley is suitable for road construction in Alternative A, but not in any other alternatives. Clarion River is only suitable for timber production under Alternative A. Under all other alternatives, Clarion River will be unsuitable for both timber production and road construction. Verbeck Island is not suitable for timber production or new road construction in all alternatives as it lies within the Allegheny Wild and Scenic River corridor.

Table 3-91. Timber production and new road construction by alternative in RARE II areas

RARE II Area	Acres	Management Area				Suitable for Timber Production				Suitable for New Road Construction			
		Alternatives				Alternatives				Alternatives			
		A	B	Cm	D	A	B	Cm	D	A	B	Cm	D
Tracy Ridge	9,188	6.4	8.2	8.2	5.2	No	No	No	No	No	No	No	No
Cornplanter	3,012	6.4	8.2	8.2	8.2	No	No	No	No	No	No	No	No
Clarion River	3,440	6.1	7.2	7.2	7.2	Yes	No	No	No	Yes	No	No	No
Allegheny Front	7,424	6.4	8.2	8.2	5.2	No	No	No	No	No	No	No	No
Minister Valley	1,375	6.1 6.2	2.2	5.2	5.2	Yes	Yes	No	No	Yes	No	No	No
Hearts Content	200	8.0	8.3	8.3	8.3	No	No	No	No	No	No	No	No
Verbeck Island	14	8.1	8.1	8.1	8.1	No	No	No	No	No	No	No	No

Cumulative effects

The cumulative effects discussion of potential Wilderness Study Areas occurs in two primary contexts. The first occurs in the context of the National Wilderness Preservation System (NWPS) and other designated wilderness areas in the Mid-Atlantic Region (Delaware, Maryland, New Jersey, New York, Pennsylvania, West Virginia and Ohio).

The second context of the analysis addresses the degree to which the proposed Wilderness Study Areas will change over time under each alternative. The analysis establishes the magnitude and significance of cumulative impacts by comparing the environment in its present state with the expected impacts of the alternatives and/or other actions on private, state and federal lands within the ANF. In order to factor natural and human caused changes, the time span for the analysis includes past, present and future actions based on a 50 year time frame from 1980 to 2030.

NWPS in the mid-atlantic region and Ohio

Alternatives A and B

Viewed in the context of a limited wilderness resource on the ANF, 9,031 acres or 2 percent of the Forest, no new wilderness could have a spatial displacement effect where people will seek other locations within the Mid-Atlantic and Ohio Region for their wilderness experience. Within this area, Delaware and Maryland have no wilderness. Other existing wilderness can be found in New Jersey (10,341 acres), New York (1,363 acres) Ohio (77 acres), and West Virginia (89,166 acres). The Adirondack State Park in New York also provides a wilderness-quality resource with approximately one million acres managed for wilderness values however the Park is not included in the NWPS. This displacement could put pressure on the relatively small number of other wilderness resources in the Region resulting in over crowding, a diminished wilderness experience and resource damage in these areas.

National Forest Wilderness recreation use is predicted to grow from about 9 million visits in 1990 to an estimated 25 million visits in 2030 (Cordell *et al.* 1999). Growth in recreation use of Wilderness is expected to be slow to moderate between 1990 and 2010, with an increase of 6 million visits over this 20-year period. The National Forest Visitor Use Monitoring (NVUM) Report indicates that there were 13 million visits to NFS-administered Wildernesses in 2002. This number represents about 6 percent of the total FS recreation use.

Visitor use of wilderness areas on national forests in the East (including the Mid-Atlantic Region and Ohio) is forecasted to grow 0.5 percent per year for the next 50 years (Cordell 1999). Given a 0.5 percent projected growth per year (Table 3-92), wilderness visits for the ANF were projected to the year 2030 based on the visits recorded by NVUM.

Table 3-92. Projected wilderness visits for the ANF

Actual Use (Visits)	Projected Use (0.5% growth per year) (Visits)		
	2010	2020	2030
36,815	38,314	40,266	42,321

Based on current use projected to the year 2030, visits will increase from 36,815 to 42,321. According to wilderness recreation demand pressures developed from the Recreation, Wilderness, Urban Forest and Demographic Trends Research group, Ken Cordell, Project Leader, the visitor demand on the current wilderness areas on the ANF are projected to be moderate for the next 10 to 15 years.

Given these growth estimates, the current supply of wilderness in the Region and ANF will continue to see increased visitor use. However, it is uncertain if the current supply of wilderness is sufficient enough to serve this growing use. Under Alternatives A and B, small areas such as Hickory Creek and the Allegheny Islands Wilderness areas may not be able to serve an expanding user base without overcrowding and degradation to resources.

Alternatives Cm and D

Alternatives Cm and D provide opportunities for expanding the wilderness resource on the ANF by adding 12,379 and 29,981 acres respectively. Outside the ANF, there are 100,947 acres in the NWPS in the Mid-Atlantic and Ohio region. Primarily these acres are located on the Monongahela National Forest (MNF) in West Virginia, on US Fish and Wildlife Service land in New Jersey and on the ANF in Pennsylvania. Ohio, Delaware, Maryland, and New York, with their long settlement histories, are predominantly private, extensively developed and roaded. New Jersey is also heavily populated and extensively developed. ANF and MNF lands are thus uniquely able to provide wilderness opportunities in the region. The question remains, however, of whether the region needs more wilderness opportunities. On this topic, as previously discussed, the public is divided. While some will argue the current NWPS land base is sufficient and any additions will detract from other competing uses, others feel wilderness quality lands are disappearing to development in the region and adding potential wilderness now represents the only permanent option for preserving wilderness before future opportunities disappear. Alternatives Cm and D address this regional wilderness resource situation by offering potential wilderness additions.

Actions within the ANF that may affect wilderness study areas

Past and present actions

A summary of past and present actions for each area follows.

Tracy Ridge (9,033 acres) and Allegheny Front (6,742 acres)

Tracy Ridge and Allegheny Front were harvested for hardwood timber between the late 1880s and 1940s and the entire area consists of mid-structural (<150 years) second growth. There has been no large scale timber harvest since that time except for some small scale non-commercial release of aspen that occurred in Tracy Ridge prior to 1980. The last commercial timber cutting occurred in 1966 and included primarily thinnings. No wildlife habitat or scenery improvement work has been conducted in the last 25 years other than bat box installation along the Allegheny Reservoir shoreline at the boat-to campgrounds. Vegetation management has been limited due to the National Recreation Area designation; however limited herbicide use has occurred to control gypsy moth through the use of Bt and Dimilin in the early 1990s.

Recreation management activities within these areas have included construction and maintenance of trails and several campgrounds within Tracy Ridge. Primarily, construction and maintenance activities have been limited to the immediate vicinity of the campgrounds or within the trail corridors.

Both Tracy Ridge and Allegheny Front are encumbered by outstanding mineral rights with roughly 95 percent of the subsurface mineral rights owned by private parties. Drilling and associated mineral development has occurred in the past; however past well sites appear to be abandoned. There is currently a proposal to test drill in Tracy Ridge however no wells have been drilled to date.

There is current mineral drilling and exploration along the eastern edge of Allegheny Front and there is widespread development on adjacent private and FS lands. Current development within the central east side of the Allegheny Front portion of the NRA on approximately 50 to 100 acres of FS lands is occurring. An environmental assessment completed in 1981 addressed mineral development within Allegheny Front. No other known development has occurred in Allegheny Front in recent years.

Over-all, natural processes are operating within these areas and they have been minimally affected by outside forces except along the border where natural processes are affected by human influence, primarily road and oil and gas development. The area has regenerated from past harvest and other land uses, and now the forest appears mature to old aged.

Minister Valley (9,145 acres)

Timber harvest activities have been occurring in the Minister area since the 1800s. By the early 1940s, the entire Minister area was harvested. Vegetation management primarily focusing on reforestation treatments continued through the 1960s and 1970s. In 1985, the largest outbreak of tornadoes in Eastern Ohio and Northwest Pennsylvania resulted in large scale blow down on the Forest including the Minister area. What timber could be salvaged was and to aid in regeneration, large stands were fenced to exclude deer from browsing. By 1997, most of the devastated area had regenerated. Unlike other areas on the Forest, the Minister area has been spared severe mortality caused by the gypsy moth or cherry scallop shell moth (Minister Watershed, Environmental Analysis Appendix, 1997, page 3).

In 1997, the ANF completed the Minister Watershed Environmental Assessment which guided management activities for intensive timber management scheduled for 1996-2006. This EA covered 7,658 acres of the 9,050 acre Minister Valley Inventoried Roadless Area. Harvest units were cut roughly 5 to 60 acres in size and occur primarily along the periphery of the area and to varying degrees along the following interior roads: FR 453, 251, 419, 250 and 420. Over the last 10 years, approximately 10 percent of the area has been harvested. Fencing has occurred throughout the harvest areas to deter deer from browsing revegetated plots.

The Minister Trail and North Country National Scenic Trail systems are prominent human-made features that cover much of the interior, especially on the west side of the area. Management activities for recreation have focused on the maintenance of these trail systems.

There are approximately 20 miles of improved and unimproved roads within the area. Approximately 11 miles of old unimproved roads have regained or are regaining a mostly natural appearance. The primary impact to the natural integrity and appearance of the area has been from road construction and reconstruction on approximately 4 miles of roads found on FR 250/420. Other forest roads including FR 251, FR 419 and FR 453 are not maintained or constructed for standard passenger vehicle; however they have been reconstructed for logging traffic and administrative use. These roads also impact the natural integrity and appearance of the area.

Minister Valley is encumbered by outstanding mineral rights with roughly 100 percent of the subsurface mineral rights owned by private individuals. There is currently no mineral drilling or exploration occurring in the RA; however drilling has occurred in the past. There are 11 inactive well sites located within the RA (source: GIS data, ANF). According to District personnel at the Bradford Ranger District, these wells have been abandoned and there has been no oil and gas development since the 1930s. There is a heightened interest in developing the area due to all time highs in the price of crude oil.

Roughly 20 percent of the Minister roadless area was designated as MA 3.0 under the 1986 Forest Plan. This area lies to the west of Forest Road 420. Within this MA 3.0 area is an oak research study in which the USDA Forest Service Northeastern Research Station has conducted for over 20 years. This study has collected 15 years of data and is the only research on the ANF concerning uneven-aged silviculture in mixed oak stands (Susan Stout, *pers. comm.* 2006). Designation as wilderness would prohibit vegetation manipulation and other silvicultural treatments such as fencing. Past investments and research conclusions that may benefit oak regeneration may be lost under a wilderness designation.

Although there has been extensive harvest, trail and road construction, the variety of landforms and dense, lush vegetation, including wetland scenery and large boulder fields, makes much of this area appear mostly natural and unmodified.

Chestnut Ridge (5,063 acres)

Between the late 1880s and 1930s the entire Chestnut Ridge area was harvested and the area presently has second growth mid structural (21-150 yrs) forest. In the last 60 years, there has been relatively little management and only 97 acres or 2 percent of the area has been regenerated through timber harvest (1965-1980). Since 1980, the only timber harvest that has occurred is 8 acres of salvage treatment associated with gypsy moth defoliation in the early 1990s. Recent management in the area has been almost exclusively associated with wildlife habitat improvement work and has included approximately 10 acres of annual opening maintenance, apple tree prune and release, native conifer and shrub planting and bluebird and wood duck nest box installation.

There are no designated trails or other developed facilities. Consequently, little to no recreation management activities has occurred. Primary activities include fishing, hunting, backpacking, hiking, dispersed camping and nature and wildlife viewing.

Chestnut Ridge is encumbered by outstanding mineral rights with 100 percent of the subsurface owned by private parties. There is some drilling and exploration occurring within the area however it is limited to two wells along the periphery. There is no other known current drilling activity. Other drilling will have occurred more than 20 years ago and these past well sites appear abandoned.

Over-all the affected environment within the interior has been minimally impacted by human disturbance and/or management activities. Natural processes are operating within most of the area. The area is minimally affected by outside forces except where oil and gas development is occurring. Forest Service management activities have not compromised the areas' natural integrity and appearance. The area has regenerated from past harvest and other land uses and now the forest appears mature to old-aged.

Future actions

Private mineral development and associated land use activities pose the greatest threat to these areas into the future. There is current interest in both the Tracy Ridge and Chestnut Ridge areas. Allegheny Front is surrounded by highly productive oil fields with extensive development on adjacent lands to the north and east. Minister Valley is also near known oil and gas fields. Future projections for oil and gas wells on the ANF could climb from 225 wells per year (based on the historic trend) to over 800 wells per year (based on the high quarter scenario – See Appendix F). In regard to private oil and gas development, there may be moderate to heavy impacts to all of these areas.

Regardless of designation as Wilderness or Wilderness Study Area, mineral exploration may occur. The Wilderness Act permits mining on valid claims and access to valid occupancies and private land. The number and intensity of oil and gas disturbance within Tracy Ridge, Allegheny Front, Minister Valley and Chestnut Ridge into the future may reduce or eliminate the present wilderness character and potential of these areas. In addition, management of these areas as wilderness may be difficult or impossible to achieve due to oil and gas development activities. One way the ANF could mitigate this effect is to acquire subsurface rights. The LRMP establishes a Plan Objective in 5400 Land Ownership to "Work with partners to acquire subsurface ownership of lands in MAs 5.1, 5.2, 7.1, 7.2, 8.1, 8.3, 8.4 and 8.5 and withdraw these lands from future mineral development.

Other activities on adjacent lands such as logging, road construction, motorized vehicle use and agricultural and residential development have the potential to affect wilderness values especially opportunities for solitude and natural sound experiences. Many people believe that "quietude" is an essential wilderness experience. The concept of quietude is tied to the wilderness definition as expressed in the Wilderness Act of 1964 (PL 88-577): "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain." Other parts of the

definition further define this as an area which retains "its primeval character...with the imprint of man's work substantially unnoticeable" and which has "outstanding opportunities for solitude...." Solitude in an area has often been interpreted only to include physical solitude, i.e., to be physically remote from works of man. Auditory solitude, i.e., quietude is also an important aspect of wilderness character and management.

Consequently, the sights and sounds of human activity diminish wilderness values by reducing opportunities for solitude. Human disturbance may be the greatest in areas that are immediately adjacent to highly developed, frequently used travelways and roads, in areas that are adjacent to motorized trails and/or other motorized recreation use (such as motorized boats on the Reservoir), and in areas that are adjacent to private lands where heavy equipment may be used on a regular basis. All areas, Tracy Ridge, Chestnut Ridge, Minister Valley and Allegheny Front abut private lands and road corridors that receive fairly constant to heavy use, especially during the spring, summer and fall. Therefore, the opportunity for solitude may be diminished in all of these areas due to motorized use and human activities on adjacent private, state or other federal lands.

Wild and scenic rivers

Affected environment

On October 2, 1968, Congress signed the Wild and Scenic Rivers Act, establishing the National Wild and Scenic River System. The Act states that the American rivers that possess "outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in a free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

In Pennsylvania and New Jersey, there are 6 nationally designated Wild and Scenic Rivers including the Upper Delaware, Middle Delaware, Lower Delaware, White Clay Creek and the Allegheny and Clarion Rivers. Of these, the Allegheny and Clarion Rivers are located on the ANF.

Existing condition

Federally designated wild and scenic rivers

The Clarion and Allegheny Rivers were included in the enabling legislation of the Wild and Scenic Rivers Act as 5(a) study rivers. In 1969, the United States Department of Interior (USDI), Bureau of Outdoor Recreation, concluded that the Clarion did not meet minimum eligibility requirements due to poor water quality (i.e., excessive acid mine drainage, inadequately treated municipal sewage and industrial wastes) and the lack of any ORVs.

In 1990, the ANF completed a WSR assessment of the Allegheny River and in 1992, Public Law (102-271), added 87 miles of the Allegheny River to the NWSRS and classified it as a Recreational River. Reacting to increased public interest in protecting the Clarion and improvement of the water quality problem, Congress authorized it for study for a second time under Public Law (102-271) and also designated Mill Creek in Jefferson and Clarion Counties as

Table 3-93. Kinzua Creek nationwide rivers inventory summary

River	County	Reach	Length	ORVs	Description
Kinzua Creek	McKean	Allegheny Reservoir to headwaters	18 miles	Heritage	Historic-(Segment includes the Kinzua Viaduct, a National Historic Register Site, which is the second highest bridge of this type on the North American continent.)

ORV = outstandingly remarkable value

a study river. In 1996, Public Law (104-314) added 52 miles of the Clarion River to the NWSRS and classified 17 miles as Scenic and 34 miles as Recreational. The study of Mill Creek has not been done, however; Mill Creek maintains its status as a designated “study” river per Public Law 102-271. None of the Mill Creek system is located on the ANF.

The Nationwide Rivers Inventory (NRI), first published by the National Park Service in 1982, is a listing of more than 3,400 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. Under a 1979 Presidential directive, and related Council on Environmental Quality procedures, all federal agencies must seek to avoid or mitigate actions that will adversely affect one or more NRI segments. The NRI included 18 miles of Kinzua Creek as eligible for further study and identified Kinzua Creek as shown in Table 3-93.

Classification

Designated rivers or river segments may be classified as Wild River, Scenic River, or Recreational River. River classifications as defined by the Wild and Scenic Rivers Act are:

Wild river: Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watershed or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic river: Rivers or sections of rivers that are free of impoundments with shorelines or watersheds still largely primitive and shorelines largely undeveloped but accessible in places by roads.

Recreational river: Rivers or sections of rivers that are readily accessible by road or railroad that may have some development along their shorelines and that may have undergone some impoundments or diversions in the past.

The Allegheny and Clarion include river segments that contain both scenic and recreational river but no wild river classifications. The FS has no authority over other federal, state, municipal or private lands within the river corridor. There are no eligible rivers located on federal lands within the ANF. Table 3-94 describes the river segments, classification and the outstandingly remarkable value for which they were designated.

Table 3-94. Outstandingly remarkable value classifications, Allegheny and Clarion Rivers

Classification	Segment Miles	Segment Description	Outstandingly Remarkable Value (ORV)
Allegheny River			
Recreational	7.1	Kinzua Dam to Route 6 Bridge at Warren	Scenic, ecological, recreational, cultural
Recreational	47.8	Buckaloons Campground to Alcorn Island (by Oil City)	Scenic, ecological, recreational, cultural
Recreational	31.7	Franklin (south end) to Emlenton (at refinery)	Scenic, ecological, recreational, cultural
Total Miles	86.6		
Clarion River			
Scenic	8.0	Portland Mills to Irwin Run	Scenic
Scenic	9.1	Cooksburg to the Piney Dam backwater	Scenic
Recreational	34.7	Remaining segments from Ridgway to Allegheny River confluence	Recreational
Total Miles	51.7		

The Allegheny and Clarion Rivers are two of 96 designated national wild and scenic rivers in the United States. They are free flowing and contain outstandingly remarkable values that not only include highly valued recreation opportunities but they also contain important habitat for wildlife and fisheries, unique vegetative communities, rich cultural histories and scenic beauty.

Allegheny River

A management plan accompanied by an EIS was developed for the Allegheny River and incorporated into the 1986 Forest Plan through Amendment 7 (September 4, 1997). This Amendment defined the corridor boundary for the Allegheny National Wild and Scenic River and provided additional forest plan standards and guidelines for managing federal lands within the designated corridor as identified in MAs 5.0, 6.1, 6.4, 7.0 and 8.0.

The Allegheny River is classified as a recreational river totaling 86.6 miles. It begins at the Kinzua Dam and flows downstream to the U.S. Route 62 Bridge, from Buckaloons Recreation Area at Irvine downstream to the southern end of Alcorn Island at Oil City and from the sewage treatment plant at Franklin to the refinery at Emlenton. The stretch of River primarily located within the ANF proclamation boundary begins at Kinzua Dam and ends roughly at Tionesta. Within the proclamation boundary, the River flows through State Game Lands and extensive areas of privately owned land. There are many homes along the River as well as seasonal recreational residences. The ANF primarily promotes dispersed recreation on the River for dispersed camping, hiking, power boating, canoeing, fishing, swimming and sightseeing.

Named "La Belle Riviere" by French explorers, the Allegheny River flows through the Allegheny Islands Wilderness Area and along broad rural landscapes. Good public access and few hazards

make this an ideal river for novice and family canoeing. Fishing for muskie, walleye, rainbow trout, and smallmouth bass is popular. Oil and gas exploration and production have occurred throughout the region since the 1860s.

There are 43,568 acres within the corridor with approximately 83 percent in other ownership (private, state or federal). The corridor is located both within the ANF proclamation boundary and outside of the boundary.

Clarion River

The Clarion River is classified as scenic for 17.1 miles and recreational for 34.6 miles for a total of 51.7 miles. Beginning just below Ridgway, this mostly undeveloped river meanders through narrow valleys of hardwood forests. Wildlife, intermittent riffles and rock outcrops provide constantly changing scenery. The Clarion is popular for family canoeing, as well as for trophy brown trout and smallmouth bass fishing. The River is considered a Class I River making it a desirable river for canoeists of all abilities. Outstanding features include a nationally recognized area of virgin white pine and hemlock in Cook Forest State Park. The River flows along private lands, state game lands, state park and forest lands and the ANF. Each entity provides an array of recreational opportunities from guided canoe trips to camping. The Pennsylvania Fish and Boat Commission establish boating regulations for watercraft on the River including powered and non-powered boats such as canoes, rafts and kayaks. The ANF primarily promotes dispersed recreation along the river focusing on canoeing, fishing and dispersed camping. There are a number of boat launch sites along the river, located both on the ANF and off. The Clarion River Water Trail has been established along the River to promote stewardship of the river resources and to emphasize low-impact use. The best time to float the Clarion is early summer when flow is generally higher. Late summer flows become shallow at times and boat bottoms can drag on the streambed. No management plan has been written for the River.

There are 2,356 acres within the scenic corridor section and 10,464 acres within the recreation section with approximately 72 percent in other ownership (private, state or federal). The corridor is located one-quarter mile on each side of the river, both within the ANF proclamation boundary and outside of the boundary.

Pennsylvania state scenic rivers

The Pennsylvania Scenic Rivers Act (as amended 1982), allows the State, Pennsylvania Department of Conservation and Natural Resources (PA DCNR) to designate and manage a State Scenic Rivers System. The Secretary of Environmental Resources is directed to encourage and assist any federal studies for inclusion of Pennsylvania Rivers in a national scenic rivers system. The Secretary may enter into written cooperative agreements for joint federal-state administration of a Pennsylvania component of the NWSRS, provided such agreements for the administration of land and water uses are not less restrictive than those set forth in this Act. There are currently no designated State Scenic Rivers on the ANF nor has PA DCNR identified any potential scenic rivers for State study since 1986.

Under the Pennsylvania Scenic Rivers system, PA DCNR listed Kinzua Creek, Clarion Creek, Bear Creek, Tionesta Creek and the East Branch of Tionesta as top priority waterways for potential State Scenic River designation. PA DCNR has revised their program since these rivers were listed in the 1986 Forest Plan. As per PA DCNR Bureau Chief Marian Hrubocvak (*pers. comm.* 2001), Greenways Conservation Partnerships Division, there is no longer any interest from the State for scenic designation of these rivers and they no longer use the “process” which identified these rivers as top priority waterways. PA DCNR’s primary emphasis is to provide study and/or conservation plans for rivers that have been identified by the state on state lands or by locals who are concerned about scenic designation for a river regardless of land ownership. The PA State Scenic Rivers program has not identified any new rivers of concern on the ANF and dropped the Kinzua Creek, Clarion Creek, Bear Creek, Tionesta Creek and the East Branch of Tionesta from consideration as State Scenic Rivers.

Direct and indirect effects

Scope of analysis

The scope of the analysis is the potential direct and indirect effects of management activities on federal land managed by the ANF. Potential direct and indirect effects will be discussed for activities on NFS lands within the Allegheny and Clarion Wild and Scenic River corridors. The potential cumulative effects area includes all private and state lands within the ANF Wild and Scenic River corridors.

Introduction to effects

Public concern is focused on the determination of eligibility of streams and rivers for inclusion in the National Wild and Scenic River System. Public concern is also focused on protection of the Allegheny and Clarion Wild and Scenic Rivers and proposed Pennsylvania State Scenic Rivers. Another concern is for preparation of a site-specific river management plan for the Clarion River.

The following analysis will address the effects of the alternatives on the Wild and Scenic River resource. The analysis will focus on the following two primary concerns which help measure the consequences (effects) of the proposed actions of the alternatives.

1. The number of rivers or river segments determined eligible for study and subsequent inclusion in the National Wild and Scenic Rivers System and Pennsylvania State Scenic Rivers program.
2. Protection of the outstandingly remarkable values of the Allegheny and Clarion Rivers.

Effects common to all alternatives

The Wild and Scenic Rivers (WSR) Act directs federal agencies to identify and re-assess eligible WSRs in their planning processes. For the LRMP, a WSR assessment was conducted to determine the eligibility of rivers or river segments given changed conditions and new information that has occurred since the 1986 Forest Plan was written. Appendix D of the FEIS documents the WSR eligibility process and outcomes of the eligibility determinations. The eligibility process also included a re-assessment of rivers listed as eligible in the Nationwide Rivers Inventory.

Under Alternative A, the current management alternative, Kinzua Creek was listed in the Nationwide Rivers Inventory as the only stream considered eligible for designation as a National Wild and Scenic River. The eligibility process included a re-assessment of Kinzua Creek which resulted in a non-eligibility determination. The eligibility process also found no new rivers or river segments eligible for further consideration and possible inclusion in the National Wild and Scenic River System. As a consequence of the eligibility assessment, in all alternatives, including Alternative A, there will be no eligible rivers for subsequent study and possible inclusion in the National Wild and Scenic Rivers System.

Also, under Alternative A, the 1986 Forest Plan identified potential State Scenic Rivers in a state-wide rivers inventory completed in 1975 under the Pennsylvania Scenic Rivers Act, P.L. 1277, as amended in 1982. The State Scenic River study corridors listed in the current plan included Kinzua Creek (34 miles), Clarion Creek (87 miles), Bear Creek (12 miles), Tionesta Creek (52 miles) and the East Branch of Tionesta (10 miles) as top priority waterways for potential State Scenic River study (FEIS pg. 3-29).

According to PA DCNR, the rivers and streams listed in the 1986 Forest Plan (Alternative A) are no longer being considered for State Scenic designation and there are no new rivers or river segments on the ANF currently being considered. Since there are currently no eligible State Scenic Rivers, none of the alternatives, including Alternative A, will address or include potential State Scenic Rivers. However, all streams on the Forest will maintain riparian values through the LRMP riparian corridor management strategy which provides a minimum buffer of 100 feet on either side of the stream or for the entire floodplain whichever is larger. See the Water Resources section of this Chapter for further analysis of watershed and riparian areas.

Other regulations

Under all alternatives, water resource projects (as defined in the National Wild and Scenic Rivers Act (P.L. 90-542)) within the designated Allegheny and Clarion River Corridors are subject to analysis under Section 7 of the Wild and Scenic Rivers Act. A Section 7 Analysis documents proposed activities on federal, state, municipal or private lands and the effects of the activity on the hydrologic function and free-flowing condition of the river. Consequently, a Section 7 Analysis makes a determination if there will be a direct and adverse effect on a designated river or congressionally authorized Study River. The Section 7 Analysis also includes a standard that governs water resources projects below, above or on a stream or tributary to a designated river or congressionally authorized study river. Determinations under Section 7(a) or 7(b) are made by the river-administering agency. The clear intent is to protect river values from the harmful effects of water resources projects such as construction of dams, boat launch facilities, bridge construction or replacement or to place riprap on private lands. For the Allegheny and Clarion River, the FS is the river-administering agency. Under all alternatives, adherence to the Section 7 analysis will be observed.

Under all alternatives, management activities are guided by the direction and provisions provided in the Wild and Scenic Rivers Act, the Clean Water Acts and the USDA-USDI Interagency Guidelines for managing Wild and Scenic Rivers (47 Federal Register 39454). Following the guidance provided in these directives will not vary by alternative. As such, protection of the

outstandingly remarkable values of the Clarion and Allegheny River will follow national direction for managing Wild and Scenic Rivers in all alternatives.

Within the River corridors, recreation trails and other developments such as campgrounds, picnic areas, boat launches, day use sites, parking areas and toilets could occur as long as the river's outstandingly remarkable values for which it was designated are protected. The Wild and Scenic Rivers Act and FSH 1909.12, 8.2 provide the over riding management direction and standards for managing developments along river corridors according to the classification of the River. In general, Recreational River segments allow for more development than Scenic River segments in all alternatives.

Under all alternatives, the ANF will foster and promote partnerships that help to manage and protect the outstandingly remarkable values of the Clarion and Allegheny Rivers. Primary partners include the Pennsylvania Environmental Council, Western Pennsylvania Conservancy, and Allegheny College.

Under all alternatives, no management plan has been developed for the Clarion River. Until a management Plan is developed, the corridor is afforded protection within a ¼ mile boundary from the ordinary high water mark on both sides of the River. Under all alternatives, a future management plan for the Clarion will be developed and incorporated into the Plan as an amendment. The River Management Plan will further define the boundary for the Clarion and provide more detailed, site specific analysis of the river resources.

Effects from each alternative

Protection of the outstandingly remarkable values of the Allegheny and Clarion Rivers.

Alternative A

Under Alternative A, the Wild and Scenic river corridors are considered suitable for timber production, road construction, private mineral development, recreation development, and scenery and wildlife management. Alternative A provides standards and guidelines listed as mitigation measures on page 4-142 of the 1986 FEIS to protect the Allegheny and Clarion Rivers from developed recreation, even-aged silviculture, roads, energy minerals, and mineral materials activities and practices. Additional management direction for the Allegheny River was incorporated into Alternative A through Amendment 7 (September 4, 1997). This amendment was based on a River Management Plan developed for the Allegheny River in 1996. The Amendment included designation of a site specific corridor boundary for the Allegheny National Wild and Scenic River and additional standards and guidelines for managing federal lands within the designated corridor. Under Alternative A, the wild and scenic river corridors were managed as an over-lay covering several management areas that included 5.0, 6.1, 6.4, 7.0 and 8.0. Any conflicts that arise in management area direction are resolved in favor of preserving the river's outstandingly remarkable values.

Alternatives B, Cm, D

Under Alternatives B, Cm and D, the revised Plan continues the 1986 Forest Plan direction to protect the values of the Allegheny and Clarion WSR however; the rivers will be included in one management area (MA 8.1) which provides management direction for protecting the Allegheny and Clarion Rivers. This Management Area will contain standards and guidelines that are specific to the Recreational and Scenic classification of the River segments. The water, wetlands, riparian areas and recreational values for the river corridors are afforded protection by MA 8.1. MA 8.1 direction follows national directives and authorities as well as agency policy to ensure protection of the river's free-flow, outstandingly remarkable values and the protection and improvement of the aquatic resources and hydrologic function of the river.

In contrast to Alternative A, Alternatives B, Cm and D no longer consider the corridors suitable for timber production. Alternatives B, Cm and D allow vegetation management activities to occur for recreation and scenery management activities, user safety, wildlife concerns, forest health or salvage of catastrophic events such as wind or ice storms. For further discussion of the suitability of timber harvest activities, see the Forest Vegetation Management section of this Chapter.

Alternative A allowed for road construction in association with timber production activities, private mineral development, recreation development, and scenery and wildlife management. Under Alternatives B, Cm and D, road construction will be allowed only for recreation development, for designated special uses, or by law to provide access to private land or valid existing mineral rights.

Cumulative effects

Turn of the century logging had a substantial impact on both the Allegheny and Clarion Rivers, however there is no conclusive information on what the effect was or what remaining influence there is from these early logging practices. The vegetative composition of the river corridors are largely a result of these early logging practices and subsequent restoration activities.

Past activities such as inadequately treated municipal sewage and industrial wastes provided the most substantial impact to the Rivers, primarily in terms of water quality. Since designation of the Rivers, regulations that control the influence of these practices were applied and the water quality of both Rivers has greatly improved.

Outside influences on the Allegheny and Clarion River include activities on State and private land within the corridors, as well as activities on NFS lands within the corridor. There are 11,168 acres of NFS and 45,237 acres of other private, state or federal lands within the corridors. The Allegheny and Clarion are highly influenced by activities that occur on these other lands. On the Allegheny, approximately 83 percent of the land is contained primarily within private ownership and on the Clarion; it is 72 percent which is primarily located in the recreational segments and not the scenic segments. There is a higher percent of NFS system lands within the Clarion Scenic river segment, therefore the likelihood of maintaining the existing scenic corridor is high especially given LRMP standards and guidelines that restrict timber production and road construction parallel to the river.

Shoreline development has the potential to expand over time. This tendency exists where extensive land is available for development of summer homes and residences. Homeowners tend to clear the natural forest environment, replacing it with lawns and ornamental plantings, reducing the amount of undisturbed forest in these areas. They also tend lawns and gardens using pesticides and fertilizers which can move off site. These activities have the potential to introduce non-native invasive species through residential development. Other potential residential effects on the river corridors include a possible reduction in scenic integrity and effects to the recreational experience within the river corridors. Continued development of the river could affect the river's over-all natural appearance. The noise and activity associated with land development activities could contribute to a diminished recreational experience.

State Best Management Practices, the Clean Water Act, and the National Wild and Scenic Rivers Act provide protection of the ORVs, water quality, and free-flow of the river on private lands within the corridor. No federal authorization or permit will be issued for activities on private lands that will directly or adversely effect or invade and unreasonably diminish the free-flowing character or ORVs on the river. However, some activities that occur on private land, such as timber harvest, road construction and other shoreline development, do not require authorization or permit involving federal authorities. It is possible that timber management or shoreline development on private lands could result in localized effects to water quality within the WSR corridor.

There are many other river protection programs in the region which also preserve water quality and river values. Currently there is a national focus on water quality issues. On the thirteenth anniversary of the Clean Water Act, in 2002, the Environmental Protection Agency (EPA) initiated a nation-wide campaign to educate the public about watersheds, water conservation, and water pollution issues. River programs also include partnership models, such as the EPA's American Heritage Rivers Initiative (AHRI). The AHRI is a federal program designed to foster community river conservation programs. The State of Pennsylvania, Department of Environmental Protection also has several programs designed to protect rivers, river corridors, and water quality. Currently there are numerous other partners and funding sources including the Land and Water Conservation Fund for water conservation projects in the State.

In all alternatives, the future management of the Allegheny and Clarion Rivers depends on management partnerships with both State and private landholders and application of federal and state water quality and river management practices, policies and regulations. Given the cooperative efforts and authorities to mitigate effects, and protect the wild and scenic river corridors, there are no known, foreseen, or planned private or State land developments that will significantly change or affect the Rivers' outstandingly remarkable values.

National recreation areas

Affected environment

National Recreation Areas (NRAs) are congressionally designated areas that have outstanding combinations of outdoor recreation opportunities, aesthetic attractions, and proximity to potential users. They may also have cultural, historical, archaeological, pastoral, wilderness, scientific, wildlife and other values contributing to public enjoyment (FSH 2371.05(1)).

The Pennsylvania Wilderness Act of 1984 established the Allegheny National Recreation Area and identified the purposes for which the NRA will be managed as follows:

- Outdoor recreation including, but not limited to, hunting, fishing, hiking, backpacking, camping, nature study, and the use of motorized and non-motorized boats on the Allegheny Reservoir
- The conservation of fish and wildlife populations and habitat
- The protection of watersheds and the maintenance of free flowing streams and the quality of ground and surface waters in accordance with applicable law
- The conservation of scenic, cultural, and other natural values of the area
- Allowing the development of privately owned oil, gas, and mineral resources subject to reasonable conditions prescribed by the Secretary under subsection (c) of this section for the protection of the area
- Minimizing, to the extent practicable, environmental disturbances caused by resource development, consistent with the exercise of private property rights

Existing condition

The ANF contains one of four NRAs in Region 9. There are 23 NRAs in 19 states nation-wide. The Allegheny NRA is the only designated NRA on the ANF comprising 23,100 acres and divided into two primary land allocations; one north of Kinzua Dam along the Allegheny Reservoir and one south of Kinzua Dam along the Allegheny River. The NRA was established under the Pennsylvania Wilderness Act of 1984 which also established the Hickory Creek and Allegheny Islands Wilderness Areas. The NRA includes Tracy Ridge, Cornplanter and Allegheny Front RARE II areas as well as the area on the Allegheny Reservoir between Cornplanter and Tracy Ridge.

The NRA contains a number of trails including portions of the North Country National Scenic Trail, the Tracy Ridge/Johnny Cake Loop trail system, and the Tanbark Trail. Several campgrounds are located in the NRA including the Hopewell, Handsome Lake and Hooks Brooks Boat-to Campgrounds located on the Allegheny Reservoir. The area is unique to the Forest primarily because of its natural integrity and scenic beauty.

These areas have had little to no vegetative management other than for trail and campground development. There has been historic oil and gas development within the areas however; most activity and associated roads have generally regained a natural appearance. The mineral rights within these areas have not been purchased and the law which established these areas allows for the development of privately owned oil, gas, and mineral resources.

Scope of analysis

The scope of the analysis is the potential direct and indirect effects of management activities on federal land managed by the ANF. Potential direct and indirect effects will be discussed for activities on NFS lands within the Allegheny National Recreation Area (NRA). The potential cumulative effects area includes all private and state lands within the ANF proclamation boundary. This area represents lands administered by other owners, both public and private, which may affect the National Recreation Area.

Introduction to effects

Public concern is focused on designation of additional NRAs. Public concern is also focused on the Allegheny NRA in regard to changes that will occur to recreation opportunities if some of the NRA were designated and managed as wilderness.

The following analysis will address the effects of the alternatives on the Allegheny NRA. The analysis will focus on the following three primary concerns which help measure the consequences (effects) of the proposed actions of the alternatives.

1. Number of areas recommended for NRA.
2. Number of areas within designated Allegheny NRA that will include recommendations as wilderness study areas.
3. Potential effects to recreation activities if the NRA is managed as wilderness.

Effects common to all alternatives

Number of areas recommended for national recreation area.

There are no additional National Recreation Areas being considered in the alternatives.

For the revision of the Forest Plan, consideration for adding additional National Recreation Areas to the alternatives was given. NRAs are areas that have outstanding combinations of outdoor recreation opportunities and aesthetic attractions on a national scale. Areas should exhibit “exemplary” or “showcase” recreational values to merit consideration for National Recreation Area designation. Each NRA is managed as a showcase to demonstrate NF management standards and programs, services and facilities (FSH 2371.03(3)).

The ANF considered the current NRA on the Forest as meeting the need for NRA designation especially given that Pennsylvania is one of only 19 states that contribute to the system. The ANF also considered additional areas for NRA designation, however; no additional areas were identified as “outstanding” or “showcase” examples especially when compared to the Allegheny NRA or other NRAs in the Region. Additionally, areas that contain outstanding or showcase recreation opportunities are already included in other designations on the Forest such as Tionesta Scenic and Research Natural Area, Hearts Content Scenic Area, Hickory Creek and the Allegheny Islands Wilderness Areas and the Allegheny and Clarion Wild and Scenic Rivers. These areas are available for recreation and provide similar benefits and opportunities that the NRA provides.

Although not considered a National Recreation Area, the proposed Remote Recreation Areas in Management Area 7.2 include management strategies that emphasize recreation and promote conservation of these areas in a roadless or near roadless condition. Management Area 7.1, Developed Recreation Areas, also emphasize recreation opportunities in some of the most outstanding areas on the Forest such as Kiasutha, Twin Lakes, Red Bridge, Buckaloons, Kinzua Beach, Beaver Meadows, Dewdrop, Lolita and Willow Bay. Consideration as administratively designated Remote Recreation Areas

and/or Developed Recreation Areas is responsive to this issue by providing and preserving these areas for a combination of outdoor recreation opportunities that range from remote, non-motorized activities to highly developed areas designed for user comfort and convenience.

Effects from each alternative

Alternative A

Rather than develop a specific management plan for the NRA, the ANF incorporated standards and guidelines in the current Plan in accordance with the purposes of the Pennsylvania Wilderness Act of 1984 which established the Allegheny National Recreation Area and the laws, rules, and regulations applicable to the NFS. No forestwide standards and guidelines were developed for the NRA, only management area standards and guidelines were developed.

The entire NRA was assigned to Management Area 6.4 which emphasized enhancement of dispersed semi-primitive motorized and non-motorized recreation opportunities and protection of the natural scenic, scientific, historic, archaeological, ecological, educational, watershed and wildlife values. Under Alternative A, Tracy Ridge Campground, Willow Bay Campground, Roper Hollow Boat Launch and Webbs Ferry Boat Launch are included in the NRA.

Alternatives B, Cm, and D

The revised Plan continues the 1986 Forest Plan direction to manage the NRA for the purposes established in the Pennsylvania Wilderness Act of 1984. The Allegheny National Recreation Area will continue to be managed under specific Management Area direction. Under Alternatives B, Cm and D, Tracy Ridge Campground, Willow Bay Campground, Roper Hollow Boat Launch and Webbs Ferry Boat Launch have been assigned a MA 7.1 developed recreation area prescription which emphasizes high density recreation developments.

Number of areas within designated Allegheny NRA that will include wilderness study designation.

National Recreation Areas may have multiple designations that include Wilderness, Wild and Scenic River, Research Natural Area, etc. Alternative D considers portions of the NRA as wilderness study. Designation as wilderness study will not eliminate the NRA designation as there will be a dual designation of wilderness and NRA. However, management area allocations will change in order to emphasize more restrictive wilderness management standards and guidelines which supersede the less restrictive management direction established for the NRA.

The Allegheny NRA contains three land units, Tracy Ridge, Allegheny Front and Cornplanter, and one water unit located on the Allegheny Reservoir between Cornplanter and Allegheny Front. Only Tracy Ridge and Allegheny Front are being considered for a Wilderness Study Area prescription (MA 5.2). Table 3-95 shows the areas of the NRA that will be managed as wilderness study.

In all alternatives, Cornplanter and the Allegheny Reservoir units will be managed under the National Recreation Area prescription (MA 6.4 or MA 8.2). In alternatives A and B, no areas of the NRA will become wilderness study. The acreage change from 23,100 acres in Alternative A to 22,750 acres in

Alternative B is due to the reassignment of Tracy Ridge Campground, Willow Bay Campground, Roper Hollow Boat Launch and Webbs Ferry Boat Launch from MA 8.2 to MA 7.1. Alternatives Cm and D also include this reassignment. This management area change allows management to emphasize these facilities under MA 7.1 while in concert with the enabling legislation which created the NRA.

In all alternatives except Alternative D, the NRA will be managed as 6.4/8.2 (National Recreation Area). In Alternative D, Tracy Ridge and Allegheny Front will receive a MA 5.2.

Potential effects to recreation activities if the NRA is managed as wilderness

There are a number of recreation activities that may be affected if the NRA is managed as wilderness. Table 3-96 provides a summary of several major recreation activities and indicates whether or not these activities will be allowed in either the NRA (MA 8.2) or wilderness (MA 5.0).

Table 3-95. Management areas allocated in the NRA by alternative

Areas	MA Prescription			
	A	B	Cm	D
Tracy Ridge	6.4	8.2	8.2	5.2
Allegheny Front	6.4	8.2	8.2	5.2
Cornplanter	6.4	8.2	8.2	8.2
Allegheny Reservoir	6.4	8.2	8.2	8.2
Total Acres Wilderness	0	0	0	15,775

Table 3-96. Activities allowed in NRA vs. wilderness

Activity	NRA (MA 8.2)	Wilderness (MA 5.1)
Hiking	Yes	Yes
Cross country skiing	Yes	Yes
Mountain biking	Yes	No
Equestrian	Yes	Yes
Snowmobile	No	No
ATV/OHM	No	No
Primitive camping	Yes	Yes
Developed camping	Yes	No
Fishing	Yes	Yes
Hunting	Yes	Yes
Trapping	Yes	Yes

Effects common to all alternatives

Under all alternatives, snowmobiling and ATV/OHM use will not be allowed in either NRA or wilderness. Mountain biking and developed camping will not be allowed in wilderness while it will be allowed in the NRA. Developed camping includes camping at any large or small scale developed campground or campsite such as Hopewell or Handsome Lake Boat-to sites. Hiking, cross country skiing, equestrian use, primitive camping, fishing, hunting and trapping are allowed in both areas.

The NRA allows for greater recreation use than wilderness designation and provides greater alteration of the land to manage and maintain trails, scenery, wildlife, and forest health conditions. Future planning for the NRA could result in increased opportunities for development of overnight facilities such as Adirondack shelters and dispersed campsites for hikers as well as increased trail development opportunities for mountain biking and horse use. Designation as wilderness will eliminate or restrict future options for these types of recreation activities and improvements in the NRA.

Wilderness designation will restrict trail maintenance on the North Country Trail and other existing trail systems to the use of non-motorized equipment and non-mechanical transport of supplies and personnel. Historically, chainsaws and mechanical transport have been used to maintain these trails. With the restriction on use of chainsaws and other mechanized equipment, maintenance of the trail system will be more challenging and time consuming. Trail directional signing and marking will conform to wilderness sign standards. Existing signs and trail markers will need to be replaced or removed in order to meet wilderness standards.

Wilderness designation may also warrant future public use restrictions by limiting visitor use and distribution including establishment of group size limits to preserve the wilderness character of the area, whereas, the NRA allows for greater visitor use and group size limits. Currently, there are no restrictions on group size within the NRA under any alternatives.

Recreation objectives for wilderness are to provide outstanding opportunities for solitude and primitive or a primitive and unconfined type of recreation (FSM2323.11 (2)). Campsites should not be designated and existing camps should be relocated or removed to allow maximum opportunity for solitude and to minimize the evidence of human use. The boat-to campgrounds in the NRA will not be compatible with wilderness designation. Removal of these areas will reduce benefits to other non-wilderness recreationists. Adjusting the boundary to eliminate these areas could occur; however, the campgrounds may impact some wilderness user's experience. Likewise, the large, developed Willow Bay and Tracy Ridge campgrounds located on the periphery of Tracy Ridge may also impact wilderness experiences and values.

The NRA allows for motorized use of boats on the Allegheny Reservoir, for landing and exploration of the shoreline and camping at the designated boat-to campgrounds. Wilderness designation excludes the use of motorized equipment or mechanical transport including the use of motorized boats landing on shore. Establishing the boundary above the high water mark will allow this use to continue however, use of boats on the Reservoir may still impact some wilderness users' experience.

Wilderness designation advertised and included in a broad tourism planning effort may draw visitors attracting recreationists seeking remote, primitive and unconfined types of recreation and solitude. However, the NRA

currently provides many wilderness values including the opportunity for solitude and serenity, self-reliance, adventure, challenging experiences, and semi-primitive recreation. For many recreationists, primeval wilderness character is less important than protection (Loomis, 1999). The NRA designation was considered an alternate to wilderness designation with the intended purpose of protecting the wild, undeveloped character of the area. This designation protects the area from timber harvest, road construction and most road based recreation.

Cumulative effects

The cumulative effects discussion addresses the degree to which the National Recreation Area will change over time under each alternative. The analysis establishes the magnitude and significance of cumulative impacts by comparing the environment in its present state with the expected impacts of the alternatives and/or other actions on private, state and federal lands within the ANF. In order to factor natural and human caused changes, the time span for the analysis includes past, present and future actions based on the time frame of establishment of the NRA in 1984 to the end of the planning cycle in 2020.

Past and present actions

Since the establishment of the NRA under the Pennsylvania Wilderness Act of 1984, past and present actions have primarily included recreation management activities associated with maintenance of the facilities and trails within the area. Activities associated with the construction and/or reconstruction of trails and facilities have included the removal of vegetation and subsequently altered the natural appearance of these areas. However, these impacts have been limited to the immediate vicinity of the facilities or trail corridor. Over-all, recreation management activities have not altered the purpose for which the area was designated. These recreation management activities have helped to direct and control visitor impacts while providing enjoyment and use of the area.

Past and present oil and gas development has also occurred. Currently, oil and gas development activities have caused minimal disturbance to the environment. Timber harvest and new road construction has not occurred since the area was designated. There has been very limited to no wildlife management activities within the area.

Recreation activities within the NRA have been limited to non-motorized uses within interior areas and motorized uses on the Reservoir and exterior campgrounds (Tracy Ridge and Willow Bay). ATVs and snowmobiles have not been allowed in the past. Hiking trails within the area have been managed for mostly single use and did not incorporate multi uses. Equestrians have been allowed to ride cross-country and are currently prohibited from using developed trails within the area. Likewise, mountain bikes are allowed off trail but not on-trail. By prohibiting equestrians and mountain bikers on hiking trails, potential conflicts between users are reduced and resource damage is limited to impacts caused from foot traffic rather than hooves and bicycle wheels. Conversely, equestrians and mountain bikers traveling cross country on undesignated routes is an unmanaged activity that results in unplanned travelways, erosion, watershed and habitat degradation, and impacts on cultural resources (USDA FS, Four Threats to the Management of National Forests and Grasslands, 2000).

Future actions

The LRMP considers two areas within the NRA, Tracy Ridge and Allegheny Front for Wilderness Study Areas in Alternatives Cm and D. Under all alternatives, the National Recreation Area designation will remain regardless if it is designated as wilderness. However, the wilderness designation will govern how they will be managed and more restrictive measures that protect wilderness values will apply. A detailed discussion on the effects of this designation has been discussed in the Wilderness cumulative effects section in this Chapter.

Private mineral development and associated land use activities pose the greatest impact to the NRA into the future. As mentioned in the Wilderness section (Section 3.4.2.3), Tracy Ridge is currently being test drilled to determine the economic feasibility of additional development. Allegheny Front is surrounded by highly productive oil fields with extensive development on adjacent lands to the north and east. Future projections for oil and gas wells on the ANF could climb from 225 wells per year (based on the historic trend) to over 800 wells per year (based on the high quarter scenario – See Appendix F). In regard to private oil and gas development, there may be moderate to heavy impacts to the NRA, especially Tracy Ridge and Allegheny Front. One way the ANF could mitigate this effect is to acquire subsurface rights. The LRMP establishes a Plan Objective in 5400 Land Ownership to “Work with partners to acquire subsurface ownership of lands in MAs 5.1, 5.2, 7.1, 7.2, 8.1, 8.3, 8.4 and 8.5 and withdraw these lands from future mineral development.

Future recreation activities in the LRMP allow for construction of small Adirondack type huts along the trail system. Trails, except the North Country National Scenic Trail, will be reconstructed where feasible to allow for multi-use hike, cross-country ski, mountain bike and equestrians. Cumulative effects will be minor, short-term, localized adverse impacts due to construction/reconstruction projects occurring in the area.

Increasing recreation opportunities may result in more use and enjoyment of the area by a wider range of people. However, increasing recreation opportunities may lead to conflicts between user groups on some trails and in some areas. Those seeking more quiet and solitude may be impacted by additional noise and activity. Cross country mountain bike use will be prohibited in Alternatives B, Cm, and D. This will lead to less resource damage as mountain biking will change from an unmanaged use to a managed use. For all activities, future management emphasizes the protection, preservation, and enhancement of the National Recreation Area consistent with the Pennsylvania Wilderness Act of 1984. Based on the protection and mitigation measures provided under legislation, policy and the proposed Forest Plan, the cumulative effects from federal actions on the NRA should be low.

3.4.3 Administratively Designated Special Areas

This section has been updated to reflect modifications to the DEIS Alternative C.

Certain limited areas of NFS lands not designated as wilderness and containing outstanding examples of plant and animal communities, geological features, scenic grandeur, or other special attributes merit special management. These areas are designated by law, or may be designated administratively, as special areas. Areas so designated are managed to emphasize specific values. Other uses are permitted in the areas to the extent that these uses are in harmony with the purpose for which the area was designated.

The ANF currently contains the following administratively designated Special Areas

- Research Natural Area
- Scenic Area
- Experimental Forest
- Historic Area

Affected environment

Research natural areas

The FS designates and manages research natural areas (RNAs) to permanently protect and maintain areas in natural conditions for the purposes of conserving biological diversity, conducting non-manipulative research and monitoring, and fostering education. Included in this network are:

- High quality examples of widespread ecosystems
- Unique ecosystems or ecological features
- Rare or sensitive species of plants and animals and their habitat

The ANF contains the Tionesta Research Natural Area (2,113 acres). The RNA helps protect biological diversity at the genetic, species, ecosystem and landscape scales. The Tionesta RNA is representative of the Allegheny High Plateau Subsection of the Northern Unglaciaded Allegheny Plateau Section within the Laurentian Mixed Forest Province ecological mapping unit. This area is a quality example of the broader ANF ecosystem.

Tionesta RNA has been managed to maintain the natural features for which it was established and to maintain natural processes. Because of the emphasis on natural conditions, it is an excellent area for studying ecosystems or their component parts and for monitoring succession and other long-term ecological change. Non-manipulative research and monitoring activities are encouraged in the RNA and can be compared with manipulative studies conducted in other areas. The RNA serves low-impact educational activities without recreational development of facilities or trails. This area is available for educational use by university and school groups, native plant societies, and other organizations interested in pursuing natural history and educational field trips.

Scenic areas

A scenic area is a unit of land with outstanding natural beauty that requires special management to preserve this beauty. The ANF contains the following two administratively designated scenic areas:

- Tionesta Scenic Area (2,018 acres)
- Hearts Content Scenic Area (122 acres)

Tionesta and Hearts Content are also included in the National Registry of Natural Landmarks. The National Registry is administrated by the U.S. Department of Interior, National Park Service. The registry represents important examples of the Nation's natural history.

These Scenic Areas are used primarily for recreation and nature study. Bird watching is popular with numerous species that prefer old growth forests like barred owls, northern goshawks, pileated woodpeckers, flycatchers, thrushes, and warblers.

A portion of the North Country National Scenic Trail passes through the Tionesta Scenic Area. This trail can be accessed along the entrance road and is marked with blue diamonds. The Twin Lakes Trail, marked with gray diamonds, traverses the southern part of the Scenic Area. This trail connects the North Country Trail with Twin Lakes Recreation Area and is 15.8 miles long. Other trails that take off from the entrance road are not maintained.

Hearts Content is a small area of 300 year old white pine. There is a 1.3 mile interpretive trail that highlights the old growth forest. The Hearts Content Recreation Area and campground provides access to the area as well as to Hickory Creek Wilderness which is adjacent to Hearts Content.

These areas contain exemplary characteristics that define high quality scenery. They contain old growth forests whose natural cycle of growth has not been disturbed by logging. Primarily, these areas contain outstanding aesthetic values related to old growth forests and associated big, beautiful trees. They serve as a primary scenic attraction and recreation destination for visitors to the Forest. The landscape provides high scenic integrity; however there is evidence of human disturbance. Oil and gas development within the Tionesta area has altered the natural condition and scenery. Wind damage and insects and disease have also altered the landscape.

As mentioned, these areas contain a predominance of old growth as well as mid- and late structural forests composed of hardwoods and conifers. The old growth provides aesthetic and spiritual values as well as habitat for a number of plants and animal species that tend not to occur in younger forests. These areas contain dense tree canopies as well as large natural openings that support the physical structure for nesting, hiding, and plant growth. This is provided by standing and down dead trees, thick bark, complex crown structures, heavy branches, and undisturbed duff and litter layers. These areas provide for stream protection and input of large down wood that creates more complex aquatic habitat, shading of stream waters to keep them cool, and filters for sediments.

Recreation management has focused on maintaining the most natural recreation setting possible. Existing facilities and trails have been maintained and enhanced. Recreation impacts have been managed to protect scenery and to minimize visual disturbance.

Historic areas

A historical area is a unit of land possessing a significant site or a concentration of sites, buildings, structures, or objects united historically or prehistorically by plan or physical development. Memorial areas are included in this definition. The ANF administratively designated the Buckaloons Historic Site in an amendment to the current Forest Plan, Amendment No. 4, October 4, 1994, however no goals, objectives, standards or guidelines were defined. Buckaloons was also contained within Management Area 6.1.

The Buckaloons Historic Site is a late woodland 300-acre Seneca-Iroquois settlement located on the Allegheny River near Irvine, Pennsylvania. Throughout the Holocene, the Allegheny River watershed served as a major transportation, trade, and communication artery for Archaic (8500-1000 BC) and Woodland (1000 BC-AD 1600) cultures. The Buckaloons site has the longest human occupational record in northwestern Pennsylvania with discontinuous occupation in both prehistoric cultural periods identified above (Lantz 1999).

Prior to European settlement, several cultures occupied the Buckaloons site including the Late Woodland (AD 1000-1600) Allegheny Valley Iroquois and the Historic (1600-1800) Seneca Iroquois. Settlement patterns of these groups are generally characterized by base camps on river terraces surrounded by large catchment areas from which raw materials were procured at ancillary sites (Ruffner and Abrams 1999). These native groups were semi-sedentary horticulturists practicing swidden agriculture whereby forests were cleared and burned to create open areas in which sunflower (*Helianthus annuus*), maize (*Zea mays*), squash (*Curcubita pepo*), and beans (*Phaseolus vulgaris*) were cultivated (Snow 1994). By AD 1500, settlements were large, pallisaded villages with longhouses and garden plots capable of supporting up to 250-300 people (Snow 1994, Quinn and Adovasio 1996).

Kane Experimental Forest

The Kane Experimental Forest (KEF) is located on the ANF about 7 miles southeast of Kane, PA. The 1,737 acres of forest land that comprises the experimental forest were formally dedicated to research for the Allegheny Forest Experiment Station (now the Northeastern Research Station) in 1932. KEF is currently managed by the staff of the Forestry Sciences Laboratory in Warren, Pa where research is focused on understanding and managing forest ecosystems of the Allegheny Plateau Region. Since the establishment of KEF research has been conducted continuously on the forest.

The Kane Experimental Forest ranges in elevation from about 1800 to 2100 feet above sea level, primarily on flat to gently sloping land. The Wolf Run and Ackerman Run drainages cross KEF, as do the Mill Creek and Twin Lakes trails. The forest stands on KEF are typical of the Allegheny Plateau. They resulted from a series of cuttings made in the original hemlock-beech-maple stands. The first cutting, made in the mid-to late 1800s removed the hemlock and the best hardwood trees to supply the local tanneries and sawmills. Most of the remaining hardwoods were cut between 1890 and 1925, but a few stands were clearcut as late as 1937.

Today, KEF contains second growth stands ranging from 60 to about 100 years of age, a few third-growth stands 20 or 40 years old, and one tract containing remnant old growth. Most stands are even-aged in character, although they may actually contain several age classes because of the previous sequence of cuttings. The most common tree species are black cherry, the maples and beech; but many other species are present: yellow and sweet birch, eastern hemlock, cucumber, yellow-popular, white ash and others. Beech and striped maple seedlings dominate

the understory of many unmanaged stands, joined by black cherry and black birch in managed stands. These forest stands represent the Allegheny hardwood, or black cherry-maple, northern hardwood, including hemlock-hardwood and beech-birch-maple, and upland hardwood, or red maple-dominated, forest types.

Most research on the Forest consists of relatively long-term studies. Long-term field experiments and measurement programs have focused on regeneration studies and the environmental factors affecting the natural regeneration of Allegheny hardwoods. Currently researchers are working to develop concepts and tools needed to predict ecosystem structure, function, and species composition in terms of regeneration and forest renewal, stand dynamics and silviculture, and sugar maple decline. Most of the research on the Kane Experimental Forest is focused on stand dynamics and silvicultural research. There are currently 17 active and 23 inactive studies, monitoring sites and demonstration areas.

Direct and indirect effects

Scope of analysis

The scope of the analysis for direct and indirect effects includes all federal land managed by the ANF. This area represents NFS lands where current or potential administratively designated areas may exist, and the lands that could receive impacts from the alternatives and associated administrative actions.

The scope of the analysis for cumulative effects includes past, present and future actions that may potentially affect these special areas including actions administered on other ownership, both state and federal, within the ANF proclamation boundary.

Introduction to effects

Public concern is focused on designating additional special areas on the ANF other than wilderness, national recreation areas or wild and scenic rivers. These areas have been addressed in Section 3.4.2 of this Chapter. To address the administrative special areas issue, the ANF considered additional land allocations for research natural areas, scenic areas, historic areas and experimental forest.

Effects from each alternative

Research natural areas

There are no additional research natural areas (RNAs) being considered at this time. The ANF currently contains the Tionesta Research Natural Area which is protected and maintained in a natural condition for the purpose of conducting non-manipulative research and for fostering education. The ANF also contains 9,031 acres of wilderness and 23,100 acres of National Recreation Area that do not undergo silvicultural or other intensive land management prescriptions and can be used for non-manipulative research purposes. These areas are some of the best representative “natural condition” areas on the ANF. Also, the proposed remote recreation areas and wilderness study areas more closely resemble natural conditions than other areas on the ANF as these areas generally contain little timber harvest, roads or oil and gas development. These areas can also be used for non-manipulative research and low-impact educational activities in which natural processes and biological diversity at the genetic, species, ecosystem and landscape scales are maintained.

Under Alternative A, management direction for the RNA is contained in MA 8.5 (MA 8.0 in the 1986 Forest Plan). MA 8.5 also included management direction for scenic areas and experimental forest. Overnight camping, campfires, mountain biking off open roads, and vehicle use off open roads are not permitted in the RNA. Motorized vehicles, ATVs and snowmobiles, are not allowed on any of the trails. The Forest trails policy prohibits the use of a saddle, pack or draft animals on hiking or cross country ski trails.

The primary emphasis for vegetative management is to protect and preserve to the extent possible the natural condition of this virgin forest. Timber is not managed for commercial purposes. No salvage will be done following significant insect or disease infestations or catastrophic events.

Under Alternatives B, Cm and D the LRMP continues 1986 Forest Plan direction for the Tionesta Research Natural Area under a new Management Area dedicated to RNAs, MA 8.5. These lands are withdrawn from timber production. Unlike Alternative A, these lands are unsuitable for salvage harvest. Snowmobile and ATV/OHM is prohibited. Recreation and facility trail development is prohibited. Construction of new permanent roads will not be allowed. Like Alternative A, overnight camping, campfires, mountain biking off open roads, and vehicle use off open roads are not permitted in the RNA.

Scenic areas

There are no additional scenic areas being considered in the LRMP. A scenic area is a unit of land with outstanding natural beauty that requires special management to preserve this beauty. The ANF contains the Tionesta and Hearts Content Scenic Areas which were established because they contained remnant old growth forest which contributes to the outstanding natural beauty and scenic integrity of the areas. Other areas which contain high scenic quality are included in current designations such as the National Recreation Area, the Clarion Wild and Scenic River and the Hickory Creek and Allegheny Islands Wildernesses. The FS is not considering the designation of additional Scenic Areas because many outstanding scenic areas on the Forest are already congressionally designated areas.

Under Alternative A, there were no Forestwide goals or objectives for Scenic Areas in the 1986 Forest Plan. The Plan provided management direction and standards and guidelines in Management Area 8.0. The primary purpose for Hearts Content and Tionesta Scenic Areas is to protect the unique areas of national significance, provide dispersed recreation opportunities that emphasize the area's uniqueness and preserve the unique ecosystems for scientific, educational and scenic purposes.

Under Alternatives B, Cm and D, the revised Plan continues 1986 Forest Plan direction for administratively designated Scenic Areas. Scenic Areas will continue to be managed under a specific Management Area designed to protect the area's unique attributes while providing dispersed recreation opportunities. There will be a new Management Area, MA 8.3, dedicated to Scenic Areas with updated goals and objectives and some revised standards and guidelines. These lands are withdrawn from timber production and salvage harvest. Snowmobile and ATV/OHM is prohibited. Recreation facility and non-motorized trail development is allowed. Construction of new permanent roads will not be allowed. Like Alternative A, overnight camping and campfires will be prohibited in Hearts Content.

Historic areas

There are no additional historic areas being considered in the LRMP. Under Alternatives B, Cm and D the revised Plan will recommend national designation as a Special Interest Area (SIA) for the Buckaloons Historic Site. The USFS defines SIAs as areas managed to protect unusual characteristics. These areas are managed to maintain their special interest values. Typically, SIAs have been designated as botanical, geological, historical, cultural, paleontological, scenic, or zoological areas. SIAs may also be designated to protect and manage threatened, endangered and sensitive species, or other elements of biological diversity; or for their emotional significance, scenic values, or public popularity. SIAs vary in size from small to fairly large. The LRMP will provide management emphasis for Buckaloons within a dedicated Management Area (8.4) that will focus on protecting and enhancing the site, and where appropriate development and interpretation for public education and recreation. These lands are withdrawn from timber production, however salvage harvest may occur. Snowmobile and ATV/OHM is prohibited. Recreation facility and non-motorized trail development is allowed. Construction of new permanent roads is allowed.

Experimental forest

Under Alternative A, the 1986 Forest Plan provided management direction for KEF in MA 8.0 (renumbered 8.5 in this analysis) along with the Tionesta and Hearts Content Scenic Areas and Tionesta Research Natural Area. The primary purpose of KEF is to provide an area where research will be conducted to improve benefits from forests. Standards and guidelines for KEF and Tionesta RNA were combined. In general, timber harvesting does not occur unless associated with a pre-approved research study or as a consequence of oil and gas development of private minerals. Also, the 1986 Plan called for no new recreation developments however existing hiking trails will be maintained.

Under Alternatives B, Cm and D, KEF will be expanded to include an additional 1,700 acres. This additional acreage will provide a land base that is capable of meeting management direction to conduct research related to forest management problems and opportunities in the northeast. The LRMP will provide specific management direction for KEF including goals, objectives, standards and guidelines in a dedicated management area (MA 8.6). These lands are withdrawn from scheduled timber production. Snowmobile and ATV/OHM is prohibited. Recreation facility and trail development is not allowed; however, existing trails may be maintained. Construction of new permanent roads is allowed.

Cumulative effects

For the evaluation of cumulative effects, this analysis addresses the degree to which the existing special areas will change over time under each alternative. The analysis establishes the magnitude and significance of cumulative impacts by comparing the environment in its current naturally occurring state with the expected impacts of the alternatives when combined with the impacts of other actions. How actions have impacted resources in the past and present or how resources might respond to future impacts is addressed for each special area. In order to factor natural and human caused changes, the time span for the analysis includes 35 years ranging from 1980 to the end of the planning cycle (15 years or 2020).

Research natural area and scenic areas

Past actions

The existing condition of the Tionesta Scenic and Research Natural Area and the Hearts Content Scenic Area has been modified from both natural conditions and human activities. The Tionesta Scenic and Research Natural Areas have been managed primarily as one special area rather than two separate and distinct areas. Past management has primarily included research and recreation activities. Research activities have been non-manipulative causing no change in the unaltered, natural condition of these areas. Recreation management has included trail maintenance within the Tionesta Scenic Area and trail and facility maintenance in Hearts Content. There have been no recreation management activities (trail or facility construction/maintenance) in the RNA. These past recreation management activities have included the removal of vegetation and subsequently altered the natural appearance of these areas. However, these impacts have been limited to the immediate vicinity of the facilities (Hearts Content) or trail corridor. Over-all, recreation management activities have not altered the natural condition or purpose for which these areas were designated. These recreation management activities have helped to direct and control visitor impacts while providing enjoyment and use of the area.

These areas were designated in recognition of their unique values characterized as the “largest virgin forest in the hemlock-pine/northern hardwoods region of North America.” Although salvage harvest was allowed under the current Plan, no salvage or other timber harvest has occurred. Having never been logged, these areas represent some of the only remaining patches of the original six million acre forest that once covered the Allegheny Plateau. While past timber harvest has not altered these areas, oil and gas drilling has occurred since the 1860s. Within the Tionesta Scenic and Research Natural Areas, there are approximately 1,900 acres of known oil and gas fields (Source GIS). Within the Tionesta area, oil and gas development has significantly altered the natural condition and scenic integrity of the area. Oil and gas operations have altered the preeminent natural condition for which Tionesta was designated. The expectation is that these unique areas will be preserved with little to no human alteration. Hearts Content has had little to no past oil and gas development activity.

Natural events have also altered the unique values of these areas. Over the past 35 years approximately 1,000 acres or 25 percent of the Tionesta area received wind damage caused by tornadoes in the 1980s. Wind events are an important natural disturbance which contributes to the natural cycle of growth. However, the resultant blow down decreases the aesthetic and historic value by reducing the amount of standing old growth and remnant pine and hemlock virgin forest.

Present actions

Ongoing non-manipulative research and recreation management continues within these areas. Current recreation management activities include maintenance of the existing recreation trails and facilities. There are no current plans for additional new trails or recreation facilities. However, the Martin Run EIS 2004 will implement the relocation of the North Country Trail to a pre-tornado location and the parking area will be moved to the north edge of the area.

The affected environment continues to be modified primarily by oil and gas development and natural events such as wind throw and insects and diseases. Wells and associated access roads currently impact the aesthetic, recreational and research values. In July, 2003 another catastrophic wind event occurred causing scattered blowdown. Additionally, blow down of the area is increasing primarily along the edge or boundary of Tionesta. Timber harvest in adjacent areas exposes Tionesta to the full brunt of heavy winds and catastrophic storms. In some areas along the edge, blow down has increased.

The revised Plan does not add any new Research Natural Areas or Scenic Areas. Under all alternatives, FS management activities are limited to non-manipulative research and non-consumptive recreational uses. Standards and guidelines are designed to preserve and protect the ecologically significant natural features of these areas.

Pennsylvania's state forest system includes 61 special natural areas set aside to protect unique or unusual biologic, geologic, scenic and historic features, or to showcase outstanding examples of Pennsylvania's major forest communities. The State manages natural areas in a natural condition by allowing physical and biological processes to operate, usually without direct human intervention. These areas are set aside to provide locations for scientific observation of natural systems, to protect examples of typical and unique plant and animal communities and to protect outstanding examples of natural interest and beauty. There are 22 natural areas designated within Pennsylvania's state park system. There are two within the four county area of the ANF.

1. Forest Cathedral (555 acres). Also a National Natural Landmark with old-growth stands of white pine and eastern hemlock. Many trees are over 300 years old. Cook Forest State Park (Clarion/Forest counties).
2. Swamp Forest (246 acres). A wetland of old growth eastern hemlocks and white pines at the headwaters of Brown's Run. Cook Forest State Park (Clarion/Forest counties).

These sites meet similar objectives as the Tionesta Research Natural Area and serve as RNA equivalents adding to the ANF reference site network.

Future actions

All minerals in the RNA are USA-owned and withdrawn from development. Thirteen existing wells that existed prior to RNA designation are allowed operations with no re-drilling. Once minerals are exhausted, sites in the RNA will be restored. TSA mineral rights, conversely, are all privately owned. The TSA contains a large underground field gas storage area, and has thus not had any oil and gas development in the past decade. This storage area is of fairly high quality, and will therefore likely continue to be used as an underground gas storage area. While it is reasonable to assume that some of oil and gas development may occur on lands in the Tionesta Scenic Area, considering that there has been no oil and gas development in Tionesta in the last decade, and the area is primarily used for underground gas storage, it is not expected that there will be any substantial new private oil and gas development within the TSA in the near future.

The potential cumulative effects from natural events are of particular concern. These areas are prone to blow down and insect and disease infestations. Future naturally occurring processes, such as insect and

disease infestations and catastrophic wind events may alter these areas and their environment into the future. These events create the potential for significant mortality of existing old growth trees and virgin forest for which the Tionesta and Hearts Content areas were established. Restrictions on salvage harvest and road construction will reduce human caused disturbance, however naturally occurring events could drastically effect the current condition of the area by changing the remnant patch of virgin forest from large, old growth trees to smaller vegetation. It is also possible that species composition will change and that more and more pine will be replaced with hardwoods. Management activities to control insect and disease infestations may occur including use of chemical application. This could affect other non-target species within the area.

Additional RNA-equivalents may be added in the future as state, tribal, county, conservation and/or other entities create preserves. Ongoing oil and gas development is expected to continue on the ANF limiting potential sites for future RNAs and Scenic Areas. Future projections for oil and gas wells on the ANF could climb from 225 wells per year (based on the historic trend) to over 800 wells per year (based on the high quarter scenario – See Appendix F). Research demand for RNAs or RNA-equivalents may increase especially if oil and gas development within the Tionesta area alters the over all natural condition and value as a RNA. Research is conducted outside RNAs as well as within them, and this use is also expected to increase. Conducting non-manipulative research within designated wilderness and the Allegheny National Recreation Area may occur. These areas represent some of the best naturally occurring ecosystems on the ANF and can serve similar research needs as RNAs. However, they are not entirely off-limits to oil and gas development. Within the Hickory Creek and Allegheny Islands Wilderness areas, the oil and gas subsurface rights are owned by the federal government; however, the subsurface rights below the National Recreation Area have not been acquired. Consequently, drilling for wells within the NRA has occurred and may continue. RNA-equivalent non-manipulative research associated with the study of natural conditions within these areas may be limited depending on the extent and magnitude of oil and gas development within these areas. (See additional discussion of cumulative effects for wilderness and the National Recreation Area in Section 3.4.2).

Some non-native invasive species may infest the RNA and/or Scenic Areas in the future. It is reasonable to assume these areas could be priorities for control of infestations so that the impact on RNA values will be limited.

Based on the above analysis and information, neither the alternatives nor continued management by the FS of the Tionesta and Hearts Content areas is expected to have significant effects on the overall natural condition of these areas. Both the current Plan and the revised Plan emphasize limited human intervention and non-consumptive/non-manipulative uses. These areas are considered unsuitable for timber and salvage harvest and road construction. Since the management strategy emphasizes preservation and protection, no significant, adverse effects are expected. In regard to private oil and gas development and future natural disturbances, there may be moderate to heavy impacts to the areas, primarily Tionesta especially since it lies within a heavily modified area.

Heritage areas

Past, present and future actions

The significant heritage resources that make Buckaloons Heritage Area a special area of interest have not been lost or damaged through past or present activities, visitor use or natural events. Some changes have occurred to the natural environment from management activities however these activities have not altered the historic significance of the area. Primarily, management activities are focused on inventory, excavation, study and instituting measures to protect the unique historical values of the area. Wildlife management activities that create and maintain openings for certain species has and does occur. Design criteria for in-depth research of the Buckaloons site has protected the heritage values and enhanced the interpretive and educational values to the public.

The revised Plan does not add any new Historic Areas. Buckaloons has been managed as an administrative special area under an amendment to the current Plan. The revised Plan will change the administrative designation to one of national recognition as an identified Special Interest Area. Under all alternatives, standards and guidelines are designed to preserve, maintain and protect the historic significance of the area and wildlife habitat.

Future actions are likely to focus on continued research and protection of this heritage area. Additional interpretive and educational activities are likely to occur along with increased recreational and tourism opportunities. Salvage harvest as well as chemical treatment of non-native invasive species and insects and disease may occur. Future management emphasizes the protection, preservation, interpretation and enhancement of the historic properties of the area consistent with the National Historic Preservation Act of 1966, as amended and subsequent legislation. Based on the protection and mitigation measures provided under legislation, policy and the proposed Forest Plan, the cumulative effects on heritage resources within Buckaloons should be low.

Experimental forest

Past, present and future actions

Past and present management activities have focused on research and study of the Kane Experimental Forest using primarily manipulative research techniques such as timber harvesting and other silvicultural treatments that influence vegetation. Formally dedicated to research in 1932, KEF has and continues to provide research focusing on management of forest ecosystems of the Allegheny Plateau Region. Changes have occurred to the natural environment from research activities however these activities have not altered the research value of the area. Most research consists of relatively long-term studies that focus on regeneration and environmental factors affecting Allegheny hardwoods. While the area has emphasized research, management actions provide some production of wood products and dispersed recreation. This area also contains active oil and gas fields. There are approximately 600 acres or 35 percent of the area affected with potential for private oil and gas development. The oil and gas development will reduce the amount of area available for certain studies and adds a layer of complexity to existing studies.

The revised Plan does not add any new Experimental Forest however it does expand the Kane Experimental Forest under Alternatives B, Cm and D. Under these alternatives, standards and guidelines are designed to emphasize research and experimentation. Expansion of the area will include an additional 1,100 acres of known oil and gas fields. This could decrease the potential for some types of research proposals. Areas of expansion have had some salvage operations which are not complete.

Future actions include new and continued research studies. Salvage harvest as well as chemical treatment of non-native invasive species and insects and disease may occur. Commercial sale of timber is permitted only in conjunction with an approved research study. Future management includes the maintenance of existing trails for recreational use. Based on the diversity of manipulative research techniques that may occur, a variety of landscape conditions and species composition may exist. The landscape may be heavily modified with complete removal of vegetation and it may also contain areas where only moderate manipulations occur. Ongoing oil and gas development is expected to continue on the ANF, limiting potential studies within KEF into the future. Other management actions are guided by standards and guidelines within the LRMP. These measures are expected to minimize the long-term cumulative effects to the area.

3.4.4 Scenery Management

The DEIS described the Scenic Integrity Levels (SIL) in the LRMP as Scenic Integrity Objectives (SIOs). Confusion on the language for measuring scenery resulted in dropping the term SIO and favoring the term SIL to describe the minimum level needed to achieve desired scenic integrity.

Affected environment

Visitors indicate the visual appeal of scenic driving is one of the greatest attractions to the Allegheny National Forest landscape. To maintain this visual appeal, the Forest Service established national guidelines for managing scenery with the Scenery Management System (SMS). These guidelines are used to inventory the landscape and classify the effects of management activities. SMS updates the Visual Management System following many of the same criteria to classify scenery and establish SILs; however, it differs in how the SILs are assigned to the landscape.

Table 3-97 shows a crosswalk of VMS and SMS terms describing scenic integrity. Scenic Integrity Levels (SILs), under the SMS, define the different levels of acceptable alteration to scenic resources. These levels range from Very High (unaltered) to Very Low (heavily altered) and are based on views from the priority road or view facility. A detailed discussion of the SMS and the crosswalk between these two systems is available in Agricultural Handbook 701, Landscape Aesthetics – A Handbook for Scenery Management (USDA 1995e).

Table 3-97. Crosswalk of VMS and SMS terms

Visual Quality Objective (VMS) 1986 Forest Plan	Appearance to Casual Observer	Scenic Integrity Level (SMS) – LRMP
Preservation (P)	Unaltered	Very High (VH)
Retention (R)	Appears Unaltered	High (H)
Partial Retention (PR)	Slightly Altered	Moderate (M)
Modification (M)	Moderately Altered	Low (L)
Maximum Modification (MM)	Heavily Altered	Very Low (VL)

Table 3-98. Scenic class allocation by acre and SIL

Scenic Class	Acre Allocation	% of Forest Acres	SIL
1	182,939	25%	High
2	427,714	58%	Moderate
3	56,770	8%	Low
4	24,063	3%	Low
5	1,472	0%	Low
6	322	0%	Low
7	29	0%	Low
8	48,480	6%	Low

Scenic classes and scenic integrity levels

Under the SMS, scenic classes are the unit of measure defining scenic integrity levels (SILs). The forest acreage is represented by scenic classes from 1 to 8, and each scenic class was assigned an SIL based on forest priorities for scenery (Table 3-98). An overlay consisting of these SILs is common to all alternatives and is shown on a map in the map set provided with this document.

Scenic classes are the product of landscape visibility and scenic attractiveness. Landscape visibility represents the viewshed from points along concern level corridors and the topography without vegetation. On the ANF, all forest travelways (e.g. roads, trails, use areas, rivers, and streams) were evaluated and all major and secondary corridors were assigned one of three levels of concern as defined below. Appendix B contains a summary of the concern level inventory conducted for this forest plan revision.

Concern Level 1 (CL1) travelways and use areas include nationally and regionally important locations including primary roads, scenic byways, trails, wild and scenic rivers and other special designation areas. These CL1 areas have the highest concern for scenery based on heavy recreation traffic and the perception that scenery is one of the primary objectives for traveling these corridors. Concern Level 2 (CL2) travelways and use areas include locally important locations including secondary roads, hiking trails, streams, and all motorized trails. These CL2 areas may have high to low use, and may be traveled for dispersed recreation activities with a moderate interest in scenic viewing. Concern Level 3 (CL3) travelways and use areas include all other forest roads, trails, and streams with a low or seasonal use. The interest in viewing scenery is considered low for these CL3 corridors.

Foreground views are generally the most sensitive to viewers from Concern Level 1 and 2 roads/trails/streams. Foreground is described as 0-1/4 mile from the observer based on the standards for a flat landscape and limited distant views on the plateau; Middle ground is 1/4 - 3 miles and background is 3+ miles. These distance zones have been redefined for consistency with the national standard, resulting in a much larger middle ground and a smaller background than the 1986 Forest Plan

High SILs assigned to the foreground of the travel corridors of most concern indicate those areas of scenic importance to the visitors' experience. The North Country National Scenic Trail and Longhouse Scenic Byway are examples of scenic corridors of most concern. Management activities within High SIL areas will maintain the scenic integrity of these corridors and will not be apparent from the travelway.

Existing scenic integrity

For plan revision, the ANF completed an inventory of the current scenic condition of all forest lands in order to provide a baseline to measure change and monitor results of management. Individual timber compartments served as evaluation units to measure the existing condition. Areas with the greatest disturbance have a “very low” scenic integrity level (SIL). These areas are represented by the following three types of impacts: numerous timber stands in the 0-20 age class, extensive temporary or permanent openings, and the highest density oil and gas developments. Conversely, units with little to no disturbance have a “very high” SIL. The range of existing forest SILs includes very high, high, moderate, low, and unacceptably low (Figure 3-16).

Landscapes that have an existing SIL inconsistent with the adopted SIL are areas of most concern for scenery. Landscapes that have an unacceptably low SIL may need rehabilitation to meet the minimum low SIL. Five landscapes of most concern include the following: Westline Area (14,500 Acres), Longhouse Scenic Byway (4,000 Acres), Salmon Creek (7,000 Acres), Sackett Oil Field (10,500 Acres), and Rocky Gap ATV Trail (6,000 Acres) (a scenery impacts worksheet is in project file). The SMS recommends using “rehabilitation” as a short-term objective to move highly impacted areas such as these to the desired condition over time. An interdisciplinary approach to this rehabilitation goal could be achieved during the planning cycle. Choosing one of these areas to plan project activities would provide the opportunity to achieve scenic integrity goals while meeting the goals of other resources as well.

The LRMP sets SILs for the entire ANF. Project-level scenery analysis determines the visibility of specific stand impacts to scenery and verifies the need of mitigation to meet or exceed SILs from Concern Level 1 and 2 corridors. If mitigation is needed, “The ANF Scenery Implementation Guide” is a practical reference to assure SILs are met and mitigation is consistent across the forest.

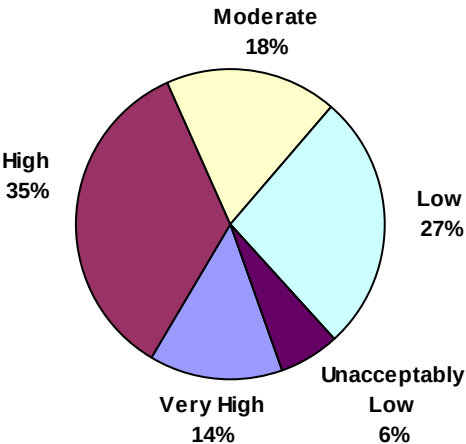


Figure 3-16. Existing scenic integrity levels, ANF
Source: GIS Inventory

Direct and indirect effects

Scope of analysis

The analysis area for the direct and indirect effects to scenery includes the federal land administered by the ANF. Land management activities directed by the LRMP have the potential to create long- or short-term disturbances that impact the scenic condition. The analysis area for cumulative effects to scenery includes the national forest and adjacent private and state lands within the ANF proclamation boundary. Effects extend to all adjacent lands that form a viewshed or landscape context for viewing the landscape. Effects will be displayed over the timeframe between 1985 and 2020 to include the current planning cycle and the time covered by the plan that preceded it. The years capture the effects of past vegetation management, new trends in recreation, and the recent spike in oil and gas production.

Introduction to effects

Scenic resources are affected when management activities alter the natural appearance of the forest landscape. Effects of forest management are both short- and long-term. Short-term impacts are those impacts that may remain on the landscape for up to 10 years. These impacts include harvest methods such as thinning, selection cuts, and uneven aged treatments; they include the impacts of treatments that pull slash back from the road corridors and lob and scatter it to break down and decompose into the moist forest soils. Tools used to regenerate oak and other species such as prescribed fire and herbicide also have effects on the scenery. Impacts of herbicide treatment are most apparent in the foreground views adjacent to a road corridor. The understory vegetation turns brown and dies, contrasting with green vegetation in untreated areas during the late summer. This contrast diminishes during fall and winter and recovers in the following spring. These effects are considered temporary impacts that are reduced during the first year and are no longer evident within three years of implementation.

Other temporary impacts, found to last no longer than one year following a management activity, include grading and seeding sites that have been disturbed. Compaction of soils from the overuse of popular recreation sites may be considered temporary or short-term impacts if mitigated by closure until grading and re-vegetation occurs. Temporary impacts also include the bright yellow treatment notification signs for herbicide that face the road and are posted for 30 days.

Long-term impacts are those that remain on the landscape after 10 years. These impacts to the forest landscape may occur from activities such as even-aged harvests and wildlife openings, and the road building, and pit exploration associated with these activities. Utility corridor construction and activity associated with communication towers (cell phone towers) also have impacts. Some uses such as wind towers are considered unsuitable on the forest based on long-term effects on scenery and other resources. Enhancement to scenery including the creation and maintenance of vistas may also be considered to have a long-term impact. These impacts are generally welcomed as they enhance the scenic driving experience and benefit recreation and tourism. Impacts to the natural forest condition also occur from the rehab and construction of new recreation and administrative facilities. Building the required trails for equestrian and ATV access of remote areas of the forest will also have long-term impacts to forest settings, yet they provide recreation experiences desired by many visitors.

Disturbance from proposed management actions are acceptable within the range of SILs assigned to all ANF lands. Mitigation guidelines are designed to reduce the disturbance to the forest setting and the impact to priority areas for scenery while allowing management to occur.

Effects based on SIL distribution

Management of scenery in the LRMP provides constant SILs along travel routes. In all alternatives, SILs are assigned as described in the scenic class discussion in affected environment, except in four management areas. MAs 5.1, 5.2, 8.1 (scenic segment), and 8.5 are assigned a very high SIL to reflect the highest standard for scenery on the ANF and to provide a four-level range of very high to low (Table 3-99).

The very high SIL allocation is consistent with the goals of the four management areas. This acreage will vary to support the alternative themes as follows: acreage for the Research Natural Area (MA 8.5) remains constant in all alternatives; acreage for Wild and Scenic River (MA 8.1 - Scenic segment) is constant in Alternatives B, Cm, and D; and acreage for Wilderness and wilderness study areas (MAs 5.1 and 5.2) is a range showing Alternative D has nearly four times the acreage of Alternatives A and B (Table 3-100).

A “very low” SIL is not included as a scenery objective in the LRMP. Table 3-101 displays the ANF distribution of SILs for each alternative. All acreage is consistent with the SMS model of scenic classes. Differences occur based on the differing acres assigned to MA 5.1, 5.2, 8.1 (scenic segment) and 8.5. An SIL map for each of the alternatives represents the ANF allocation based on these objectives (see map of Alternative Cm).

Table 3-99. Final scenic integrity level assignments

Scenic Classes	All MAs	MAs with a single SIL MA 5.1, 5.2, 8.1 (scenic segment), 8.5
1	High	Very High
2	Moderate	Very High
3	Low	Very High
4	Low	Very High
5	Low	Very High
6	Low	Very High
7	Low	Very High
8	Low	Very High

Table 3-100. Very high SIL acreage by alternative

MA	Alt A	Alt B	Alt Cm	Alt D
5.1 and 5.2	8,979	8,979	21,358	38,912
8.1 (Scenic)	0	1,151	1,151	1,151
8.5	2,111	2,111	2,111	2,111
Totals	11,090	12,193	24,620	42,174

Table 3-101. Scenic integrity levels by alternative

Scenic Integrity Level	Alt A	Alt B	Alt Cm	Alt D
Very High	2%	2%	3%	8%
High	25%	25%	24%	22%
Moderate	57%	57%	56%	55%
Low	16%	16%	17%	15%

Source: ANF Project File and Landscape Aesthetics, A Handbook for Scenery Management

Effects by alternatives

All alternatives manage for a range of diverse landscapes and natural appearing settings. The range of forest landscapes will include areas with high scenic integrity displaying little or no evidence of management activities to landscapes with a lower scenic integrity displaying dominant management activities. Standards and guidelines set forth a range of mitigation measures to minimize the effects of management activities on this range of landscapes; each alternative will follow scenery standards and guides regardless of the alternative selected (see LRMP). Management activities will not reduce the scenic integrity below the assigned SIL for a given area. All alternatives will strive to maintain the natural appearing forest landscape.

A variety of management activities contribute to changes in the existing character of the landscape and to impacts on scenic quality. Those activities with the potential of impacting the scenic integrity of the forest include vegetative management and associated activities (including road building, pit excavation, and wildlife openings), and recreation management activities and construction (including new facilities and vistas).

Vegetation management and associated activities

Vegetation management

The view from the foreground, middle ground, and background of priority travel corridors, are considered in layout and implementation of vegetative management activities. Even-aged timber harvests, dominant in MAs 1.0, 3.0, and 6.2, will have the greatest impact to scenery. Up to one-quarter of the vegetation of these forested corridors may be opened up to views of understory vegetation that may be fenced or treated with herbicide to clear fern from the forest floor and facilitate seedling regeneration. Effects of fencing and herbicide on scenery are generally temporary; even-aged treatments require more time to regenerate and to achieve a canopy and height of 20 feet. Although forest openings will occur along travel corridors, forest edges will appear natural, non-linear, and feathered to blend with the adjacent opening. The projected annual level of even-aged regeneration harvests in the first decade ranges from 699 acres in Alternative D to 2,423 acres in Alternative A. Alternatives A and B have very similar acreage projections, and Alternative Cm has approximately 670 acres of even-aged management less than Alternative A (See Table 2-2). This potential for the impact of even-aged treatment is also displayed as a percent of high impact in Table 3-102. A greater percentage of acres in the high impact category are in A and B; the least is in D.

Table 3-102. Potential impacts to scenery by alternative

	Alt A	Alt B	Alt Cm	Alt D
High Impact MAs 1.0, 3.0, and 6.2	65%	66%	57%	25%
Moderate Impact MA 2.1, 2.2, 6.1 and 8.6	26%	22%	28%	55%
Low Impact MAs 5.1, 5.2, 8.2, 8.3, and 8.5 MA 6.3, 7.1, 7.2, 8.1 and 8.4	9%	12%	15%	20%
Total Forest Land Acres	100%	100%	100%	100%

Source: SIL Alternative Map Data - GIS

Scenic road corridors may transect MAs 2.1, 2.2, 6.1, and 8.6 with scattered trees of varied heights and less than a 3-acre opening size. Mitigation measures will be applied in a manner to mitigate the effects of harvest and forest regeneration activities. The estimated annual level of uneven-aged harvesting in the first decade is 6 acres in Alternative A, 403 acres in Alternative B, 666 acres in Alternative Cm, and 300 acres in Alternative D (See Table 2-2).

In further analysis of the uneven-aged theme, the potential of harvest techniques with less impact to scenery is displayed as a percent of moderate impact (Table 3-102). A greater percentage of acres in the moderate impact category are in D (55%); the least is in B (22%).

Even-aged treatments have the most impact in high SIL areas and have the greatest need for mitigation to meet SILs; even-aged treatments in moderate SIL areas require less mitigation to meet scenery objectives. The percentage of the forest in a high SIL within even-aged harvest areas is a range from A and B at 10 percent to D at 3 percent (Table 3-103). The areas of a moderate SIL, represented as a range of 44 percent to 17 percent, have less need for mitigation to meet SILs.

Associated actions

Vegetative management is a by product of actions associated with timber harvesting such as road building, pit excavation, and wildlife habitat construction activities (See Table 2-2). Road building in the corridor is expected to vary between 5 to 8 new road miles per year; alternatives A and B represent the greatest number of road miles constructed. Road building stone will be acquired from the excavation of 70 pits per year for all alternatives; these should be located away from concern levels 1 or 2 roads to minimize effects. Wildlife opening construction is estimated to range from 8 to 20 acres; Alternatives D and A have the lowest acreage and Alternative B has the highest. Wildlife enhancements affect a range of 1,200 acres in alternative D to 2,100 acres in Alternative A. Mitigation measures for all vegetative management and associated actions will follow the standards and guides for scenery and meet the desired objectives for scenery.

Table 3-103. High impact harvesting in areas of scenic concern

Harvest Type	High SIL				Moderate SIL			
	Alt A	Alt B	Alt Cm	Alt D	Alt A	Alt B	Alt Cm	Alt D
MAAs 1.0, 3.0, and 6.2	10%	10%	8%	3%	44%	44%	40%	17%

Source: SIL Alternative Map Data – GIS. Percentages based on total NF land.

Recreation management activities and construction

Construction

Most of the existing recreation and administrative facilities complement the forest landscape in form, line, color, and texture. New facilities are required to comply with the SILs and minimize impacts to scenery when viewed from priority travel ways and use areas. The Recreation Opportunity Spectrum (ROS) and the Built Environment Image Guide (BEIG) provide guidance on the appropriate use of color and materials for each ROS setting to blend with the natural landscape and minimize impacts to scenery.

Recreation management activities

Impacts to scenery from recreation activities have both long-term and short-term effects on the landscape for developed and undeveloped sites alike. Short-term impacts include impacts from the equipment used in the construction or reconstruction of a campground; other impacts include the overuse of campsites resulting in trampled vegetation, soil compaction, rutting, and erosion. These impacts will remain short-term if actions are taken to remedy the disturbance. Other short-term impacts include the unmanaged ATV/OHM and horse use on undesignated trails. Mileage for ATV/OHM trails is expected to increase in the planning decade and designated horse trails will hopefully reduce the pressure on this type of unmanaged recreation.

Long-term impacts may result from the development and maintenance of vistas or openings to enhance scenic viewing at overlooks and along forest roads. A LRMP goal for scenery is to create five new vistas and to maintain existing vistas. The enclosed forest landscapes that are common to the ANF will benefit from the creation of this variety along scenic corridors including vistas and openings that highlight landscape features. Openings are created by the thinning and clearing of trees blocking scenic views while maintaining a tree canopy along the roadside to frame the scenery. They are maintained in Alternative B, Cm, and D with the use of selective treatments of herbicide including the cut surface method and the selective backpack foliar method. Some opportunities for vista management include the Allegheny and Clarion Wild and Scenic River Corridors, Longhouse Scenic Byway, and Concern Level 1 road and river corridors.

Cumulative effects

The construction of the dam and the early harvest practices represent some of the cumulative effects that significantly impacted the landscape of the ANF in the past. These changes frame the story of the landscape and are helpful to predict future trends. The landscape character we expect to see in the next planning cycle is the result of the collection of actions that occurred in the past, today and into the future. Landscape character on the ANF is comprised of distinctive landforms and surface water, vegetation, and land use patterns and cultural features. This cumulative effects analysis will address past, present, and reasonably foreseeable future activities impacting these aspects of the landscape character from 1985 to 2020. Scenic integrity objectives will provide the guideline to maintain scenic values and direct the management of scenery into the year 2020.

Landform and surface water

Forty years ago a major landform transformation created a new reservoir 24 miles long, with 91 miles of shoreline from the meandering headwaters of the Allegheny River. The large concrete dam structure located near the town site of Kinzua and the fluctuating water levels of the reservoir have created major impacts to the scenic integrity of this segment of the Allegheny River Valley and the Kinzua Bay. Winter views of muddy shorelines and exposed tree stumps along this south arm of the reservoir sharply contrast with the scenic views of a filled reservoir during most of the summer. The lack of a constant water level at the reservoir and the erosion that results will continue to impact the scenery during the summer recreation season. The LRMP includes a goal to maintain and create vistas. Many of these vistas could feature unique land forms and water character along the reservoir and other travelways, enhancing recreation scenic driving during the summer months. Ownership of this shoreline is primarily FS land; a small tract is owned by Seneca Nation descendants. The shoreline remains undeveloped and there are no expectations of private developments along this shoreline.

Vegetation

In 1985 the ANF had two distinct types of vegetation; the forest was represented by second growth even-aged stands of shade intolerant hardwoods, and small tracts of northern hardwood remnants were represented by forests of shade tolerant, old growth stands of hemlock and beech. As the forest matures, this second growth stand will increase in diameter resulting in a “big tree” appearance. Today 3 percent of the forest is over 110 years old, and in 2020 that number will be 11 percent increasing to 50 percent in 2065. The composition of the understory will continue to have very few shrubs and native forbs, but fern will carpet the forest floor as a result of deer browsing preferences that reduced many of the native shrubs to near extinction.

Wind was a major disturbance pattern in the past creating the mosaic of age classes we see today. Since 1985, a number of major wind and storm events have toppled 29,000 acres of both old and young stands. Salvage operations have been implemented to mitigate the effects of the uprooted trees and remaining slash and woody debris. Mitigation measures as applied to salvage treatment areas are now recognized as an important component for managing vegetation and achieving scenic integrity objectives.

Other elements of the landscape character changing in the past 20 years include disturbance from insects and disease. Some of the greatest changes to forest scenery are related to forest health, affecting the regeneration of Northern Hardwood species such as beech and hemlock. These two major components of the late structural

forests have serious health issues that will likely cause a decline in these species from the current levels. The killing front is currently marching southwest across the forest in the form of beech bark disease. Greater uncertainty is found in the impacts to scenery from the hemlock woolly adelgid. The affects of declining beech and hemlock affects is most evident in the old growth stands of Tionesta and Hearts Content Scenic Areas. A significant loss in scenic value in recent years will continue in the future.

The mosaic of ANF land and ownership patterns is complex and the areas of interspersed ownership within the ANF creates the potential of combined effects from activities on National Forests and on other land. Management activities on non-NFS land have the potential to stand out on the landscape and adversely affect the Forest's scenic resources. A casual observer may be unable to distinguish whether scenery-altering activities have occurred on private land or NFS land. The Forest's fragmented land base results in the effects of activities such as land clearing for agricultural, urban, and mineral development on private land to have made noticeable changes in the landscape. Most public land management agencies and commercial forest management corporations follow their own set of guidelines for managing scenic resources; however, no mandatory scenic quality guidelines apply to private lands. Recognizing that timber harvest impacts may be higher on non-NFS land, the potential of negative cumulative effects may be compounded when combined with the effects that will result from Alternatives A, B, and Cm that propose more vegetation management/timber harvests. (See Vegetative Cumulative Effects Discussion – Harvest Type Acres by Ownership and Harvest Projection 2006-2025, see table 3-42).

Land use and cultural features

Land use is a dynamic component of the landscape subject to business and recreation trends of the public. Local populations were aging and experiencing declines in 1985 and this trend is expected to continue to 2020. This results in a slowing in the development of new homes and private camps. Recreation demand for hunting, fishing, and camping in 1985 has shifted to recreation with higher impacts to soils and scenery. The demand for ATV/OHM riding trails has increased while the supply has been limited during the last 20 years. Although the additional trail miles planned at Willow Creek may relieve some of the pressure on existing trails, the potential for impacts to scenery remains.

OGM activity is another land use that has defined this landscape for over 100 years. Historical use is not necessarily without its impacts, for this land use currently represents one of the greatest impacts to the surface of ANF since 1985. Roads are concentrated in high density developments such as the Sackett Oil Field and are growing denser in others like Westline, and the Rocky Gap ATV area. Developments that access mineral rights are also found interspersed along the well traveled corridors of the Scenic Byway, or the North Country Trail near Salmon Creek. Access roads to above ground storage tanks frequently occur in full view from scenic roads. As a result of this activity, the Recreation Opportunity Spectrum (ROS) trends are moving from roaded natural to its sub class, Roaded Modified, indicating more impacts to the natural appearing forest landscape.

The projected estimate of new OGM developments is at a rate of 512 new wells per year (See Vegetative Cumulative Effects Discussion - Past and Future Oil and Gas Development). If the trend continues as expected, maintaining SILs in certain areas of the forest is unlikely. Although a short-term objective of "rehabilitation" can be assigned to areas falling below SILs, some heavily impacted areas may never reach their desired SIL and may remain in "Rehabilitation" throughout the life of the plan.

Utility corridor and telecommunication tower development is another land use that alters the forest landscape. The major impacts of the easements and rights of way crossing the forest happened before 1985. Impacts from existing rights of way continue to disturb the forest setting and contribute to lower Scenic Integrity Levels. Utility corridors generally follow straight lines, cutting across side slopes at highly visible angles, creating linear openings with harsh edges. Impacts are especially noticeable when combined with OGM impacts. Guidelines can generally be implemented to reduce the impacts on scenery except in areas where the terrain and vegetative patterns make it difficult to meet adopted SILs. New utility corridors have not been proposed at this time; however, proposals could occur during this planning cycle.

Telecommunication towers have been sited in highly visible and prominent locations on the landscape since 1985. Ridge lines are often favored for placement of these facilities. Scenery mitigation for these towers considers the location, placement, height, color, and type of antenna. Since the current ANF policy is to locate cell towers on private land when available, no cell phone towers are currently located on FS land. This policy could change based on current trends and the pressure from the public for telecommunications in remote areas.

The desire for forest products has influenced the settlement patterns of the Allegheny region. Cultural features such as old town sites and historic railroad grades show evidence of past logging practices. Remnants of once vibrant industries of wood chemical manufacturing and tanning are found throughout the region. Native American influence is found at locations of prime attraction to recreationists. These historic features are important cultural landscapes that are valued in the context of the forest setting. The sense of place that these features offer is unique to the Allegheny and the scenic context of them will continue to be valued and protected.

Summary

Future proposals for vegetative management on the ANF, when combined with other ownership, are consistent with levels of past treatments for all alternatives except Alternative D; projected management in Alternative D is half the acres of Alternatives A, B, and Cm. Impacts from OGM activity could double across the forest landscape resulting in a roaded forest setting that is more modified than in the past. The historic high levels of activity on the landscape are likely to continue without significant change to the landscape character.

3.4.5 Heritage Resources

This section has been updated to reflect modifications to the DEIS Alternative C.

Significant heritage resources include any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe that meet the National Register criteria per the definition in 36CFR800.16(1).

Public concern is focused on the need to protect and preserve significant Heritage Resources.

Affected environment

The ANF contains over 2,000 known sites representing a wide variety of heritage resources, both prehistoric and historic, representing over 12,000 years of human use of the forest. Prehistoric archaeological sites inventoried on the ANF include rock shelter sites, open air archaeological sites such as camp sites, village sites, lithic scatters (e.g. hunting stations, knapping stations, butchering sites, fishing areas, and specialized activity areas), and burial mounds. Historic archaeological sites inventoried on the ANF include logging camps, sawmill sites, logging railroads, oil wells, oil fields, central power systems, farmsteads, and town sites, as well as standing structures, buildings, dams and other built environment features that date from early historic times to the Great Depression and post-WWII.

Only a small percentage of the inventoried sites have been evaluated for National Register significance. Among those which have been assessed, over two dozen have been determined to be eligible for inclusion on the National Register.

Since 1990, efforts have been made to assess validity of previous assessments of cultural resources, to re-examine previously recorded heritage resources to determine adequacy of mitigation measures, and to monitor the condition and integrity of the resources. This monitoring has revealed that implemented projects were generally designed to avoid impacts to heritage resources. However, the monitoring also showed that some previous investigations missed or overlooked potentially significant heritage resources.

Information collected as a result of monitoring was then used to refine management strategies to be more up-to-date and current with State and Federal standards and guidelines and, in turn, to be more efficient and effective on the local level. Although problems still exist for heritage resources recorded before 1979, many of the other problems identified at the beginning of the last planning period have been effectively addressed at all levels of the ANF's heritage resource management program. Most notably, the Programmatic Agreement, along with establishment of historic contexts, now provides the ANF with a solid foundation for making informed decisions about identification, evaluation, registration, and treatment of significant heritage resources in order to minimize direct and indirect effects.

Direct and indirect effects

Unlike many resources, heritage resources are not renewable. Damage or disturbance is generally permanent. Although repairs may be possible in some cases, the historic nature and historic value of the resources is generally compromised once it has been disturbed.

Scope of analysis

The analysis area for direct and indirect effects includes all Federal land managed by the ANF. The analysis area for cumulative effects includes all ANF lands and the lands administered by all other owners, both public and private, within the proclamation boundary of the ANF. This is the area that most often is considered the background content or area for determining the relative significance of heritage resources. This analysis considers activities since the last Forest Plan (1986-2005) and activities through the midpoint of the second decade (2020).

Introduction to effects

Known historic and archaeological sites, and areas with high potential to contain prehistoric and historic archaeological sites, occur throughout the ANF. These sites occur in most management areas, although they are not distributed evenly. Much of the significance or value of these sites is imbedded in the spatial relationship between artifacts, features, and sites. Standards and guidelines are designed to prevent or minimize activities that can alter or destroy spatial relationships between artifacts, features, and sites. Occasional human error in implementation, however, can result in damage to heritage resource sites.

A variety of ANF management activities have the potential to result in direct impacts to heritage resources, generally through ground-disturbing activities (and occasionally through maintenance or adaptive re-use of structures). These activities include the management of vegetation, recreation, minerals, special uses, fire, roads, and trails, and facilities.

Vegetation management activities, including even-aged silvicultural regeneration harvests, even-aged silvicultural thinning harvests, two-aged harvests, and uneven-aged silvicultural harvests, pose moderate risks to heritage resources. Potential adverse effects will come primarily from the skid trails and landings associated with logging. These activities result in the greatest amount of ground-disturbance. Prescribed fire events have a relatively benign effect on subsurface heritage resources because of their short duration. However, fire management methods used to fight, control, or “mop-up” after a fire have the potential for direct effects, such as those resulting from constructed fire lines.

Potential effects from travel way management come from construction, reconstruction, and maintenance of roads and trails. Travel way management has the potential to affect heritage resource sites to the extent that these activities disturb heritage resource areas in proximity to the travel way or make site locations more accessible to the greater number of people. This is particularly true for historic period sites that have a direct association with the historical transportation network. This is also true of “high visibility” heritage resource sites such as rock shelter sites, which it is noted on this Forest not only attracted prehistoric and historic human uses but also modern dispersed recreational activities that sometimes leads to vandalism or looting episodes. Widening travel ways or shoulders, or replacing bridges can have a direct adverse effect. Altering or replacing drainage structures, such as culverts or ditches, or tread/surface material can have the potential for other direct effects and indirect effects including erosion, undercutting sites, or sedimentation. Potential effects from special use management can result from maintenance activities within easements and utility corridors. There is also some potential that gathering special Forest products may affect certain archaeological sites on the Forest that have extremely shallow archaeological deposits.

Recreation management activities, including construction and maintenance of facilities, for example, campgrounds, support buildings, and parking areas, also have potential for direct and indirect effects on heritage resources.

Potential effects from facilities management result from the maintenance, reconstruction, remodeling, and/or removal of facilities considered to be historic (i.e., buildings and structures on or eligible for inclusion for the National Register of Historic Places).

Although all of these ground-disturbing activities have the potential to adversely affect heritage resources, proper project planning and implementation, and compliance with Federal and State laws and regulations and LRMP standards and guidelines should avoid most effects. Under all alternatives, the Heritage Program will provide support to all of the resource projects, as required by Sections 106 and 110 of the National Historic Preservation Act of 1966, as amended (NHPA). This includes the identification and evaluation of heritage resources for the National Register of Historic Places (NRHP) and compliance with the ANF's Programmatic Agreement with the Pennsylvania State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation (ACHP) to identify, evaluate, treat, enhance, protect, preserve, conserve, and consult about historic properties.

Non-project related site inventory and site evaluations will occur under all alternatives, since this will provide the data base needed for land managers to develop good management approaches which adequately address heritage values. In addition, project-supportive site inventory, evaluations, and monitoring will occur under all alternatives. This information will be used to design each proposed project to avoid adversely affecting significant heritage resource sites. Site monitoring will occur for potential project impacts as well as for other occurrences such as assessing the nature and degree of damage to heritage resources caused by vandalism, visitor use, and natural deterioration and also involves identifying protective measures to employ. Opportunities for interpretation of heritage resources will be explored in all alternatives for both on-site and off-site interpretation of heritage resources taking into account significance, accessibility, and protection needs.

All of the alternatives include 306 acres in MA 8.4 to recognize the Buckaloons Historic Area.

Effects from each alternative

In short, effects to heritage resources vary only slightly by alternative.

Although all of the alternatives will provide protection for the Minister Creek area, Alternative B allocates 3,367 acres in MA 7.3, the Minister Creek Interpretive Area. This management area emphasizes interpretive recreation opportunities in a predominantly natural setting. The primary purposes of the area are to:

- Provide for heavier levels of dispersed recreation in an environment that features interpretation of heritage resources and other natural features.
- Provide environment that emphasizes older forest conditions.

Management activities are primarily directed towards creation, enhancement of recreation facilities and creative interpretive facilities. Management activities may increase vegetation to achieve vegetative diversity or older forest conditions, or to address forest health issues. All of these activities are designed, in large part, to protect, preserve, and interpret a unique type of heritage resources – rock shelters.

There is some variation between alternatives in techniques available to help protect heritage resource sites from damage caused by woody vegetation root systems. Alternatives B, C, and D provide for selective use of herbicides to help limit this damage, whereas Alternative A provides primarily for mechanical treatment (cutting), a technique leading to very limited protection.

The alternatives also vary by acres allocated to special management designations, which could have potential indirect effects on heritage resources. Special management designations (e.g. recommended wilderness study areas) could potentially lead to “lost” or reduced opportunities to do maintenance, research, and interpretation of heritage resources, especially in regard to clusters of related sites. Reductions in these opportunities will not occur because they are prohibited but because the kinds of activities desirable from a heritage resource point of view will be restricted or inhibited. For example, achieving site inventory, getting access for necessary supplies and equipment, and using certain tools will all be more difficult. Also because FS activities will be limited in such areas, sites in specially designated management areas (other than designated specially for heritage resources) decreases on-the-ground FS “presence” and increases the likelihood of looting and vandalism of sites in such management areas. Although this may be a legitimate concern at a general level, there was no basis for concern in the specific configuration of any of the Alternatives.

Cumulative effects

Site protection conditions on lands surrounding the ANF will be generally be similar to the previous planning period as the level of development pressure is expected to remain low. This will help to maintain the archaeological resource base on private land despite the low level of site protection and preservation, with the exception of State-owned lands and private sector. projects subject to Pennsylvania History Code. The trend of heritage resources at risk on private lands is not expected to accelerate because development rates are expected to remain static.

When Heritage Resources are viewed as a population of sites cutting across ownerships and jurisdictions, implementation of any of the alternatives will achieve the goal of providing protection and stewardship for heritage resources on the ANF. The FS management approach will result in increased importance of Heritage resource sites on the ANF over time, and there should be few or no adverse cumulative effects.

3.4.6 Forest Products

Several changes were incorporated in the forest products portion of Chapter 3 between Draft and Final EIS. These changes primarily resulted in updates to forest land considered tentatively suitable in all alternatives (see Appendix B for further details), lands considered suitable for scheduled timber production in each alternative, and new outcomes and outputs based on new SPECTRUM model runs that incorporated technical changes to all alternatives and changes to land allocations that would result in Alternative Cm (described in Chapter 2 and Appendix B of the FEIS). Lands considered developed (for other uses, such as roads, administrative sites, etc) were updated to correct the amount of cleared land associated with roads. This resulted in changes to the amount of forest land considered tentatively suitable in all alternatives.

Introduction

This section on forest products begins with a discussion on the demand prices and species composition for the timber on the ANF. It then describes the nature of the growing stock of timber, the volume of timber that has been harvested on the forest and the types of harvest activities that have occurred. There is also a discussion of lands that are tentatively or technically suitable for timber production. The discussion on the affected environment concludes with a description of special forest products.

The direct and indirect effects described focus primarily on suitability of lands for timber production and the allowable sale quantity (ASQ). There is also discussion on the mixes of product types, the ability to harvest on lands unsuitable for timber production, salvage harvest opportunities, and the effects on special forest products. There is also a brief discussion of cumulative effects related to timber products in the area surrounding the ANF.

Affected environment

Demand for ANF timber-related goods and services

Per capita demand in the United States for wood products continues to increase in spite of increased recycling efforts and improved efficiency of wood production (Carpenter *et al.* 2003). The Northern United States (Central, Lake, Mid-Atlantic, and Northeastern States) has 15,500 wood products, paper, paperboard, and wood furniture manufacturing companies. Based on the 1997 value of shipments, Pennsylvania, along with five other states, manufactured 65 percent of the region's wood products. The logging, wood products, paper and paperboard, and wood furniture industries in the Northern United States employed over 612,000 people in 1997 (Carpenter *et al.* 2003).

Hardwoods such as black cherry, red oak, and sugar maple are in demand worldwide for furniture, cabinets, and hardwood flooring. In Pennsylvania, a \$5.5-billion forest products industry supports nearly 100,000 jobs (USDA FS 2004e). Commercial hardwood trees from the Allegheny Plateau provide the raw materials for a variety of hardwood industries, and have timber values that rank them among the most valuable in the world. Examples include ash trees used to make baseball bats; maples used in furniture, bowling pins, bowling alleys, and maple

syrup; and oaks used in furniture manufacture, cabinets, and flooring. High quality black cherry is unique to this part of the world, and almost all of the high-quality commercial black cherry trees suited for furniture or veneer in the United States come from the Allegheny Plateau (Marquis 1975, 1990).

Information concerning long-term supply and demand projections is included in the “Analysis of the Timber Situation in the United States 1952-2050” (Haynes 2003). Table 15 of the Haynes report shows historic and projected stumpage prices for various regions of the country. Constant price increases for hardwood and sawtimber products are predicted for the northern United States from 2000 to 2050. Pulpwood prices in the northern United States are expected to remain constant through 2020, then increase through 2050. Demand will likely increase for all species of ANF sawtimber, but most rapidly for high value hardwood sawtimber such as black cherry or red oak. Pulpwood demand is likely to remain fairly stable at the current level.

Timber species harvest values

Commercial hardwood trees from the Allegheny Plateau have timber values that rank them among the most valuable in the world. Timber product values are high on the ANF, primarily due to the high value of black cherry, and to a lesser extent red oak lumber. Black cherry is currently valued the highest of commonly traded and domestically produced hardwoods (Luppold unpublished 1997). In Fiscal Year 2003, the record high values for black cherry sawtimber (\$4,898 per MBF) on the ANF were received for a 39-acre overstory removal. The total sale value was \$1.5 million, with an average value per acre of \$39,000. The overall value of black cherry on the ANF has increased since 1986, from an average of \$203 per thousand board feet (1986 dollars) to an average of over \$3,000 per thousand board feet in 2004. The value of black cherry from the ANF, adjusted for inflation, has nearly doubled in just the past 10 years.

The next most valuable hardwood species from the ANF is northern red oak. It has a more variable market and has averaged between \$400 and \$1,000 per thousand board feet in the past decade. Sugar maple has also steadily increased in value from an average of \$37 per thousand board feet (1986 dollars) to an average of over \$380 per thousand board feet in 2004. Other hardwood species grown on the ANF such as red maple, ash, yellow poplar, white oak, scarlet oak, and chestnut oak are of moderate value (currently averaging \$85 to \$185 per thousand board feet). Conifers (red pine, white pine, and hemlock) currently have the lowest timber product values on the ANF, with values generally less than \$50 per thousand board feet.

Timber sales on the ANF are normally integrated product sales. High-quality, high-value sawtimber is the primary product of interest. Pulpwood is a secondary, lower value product generated as the result of varied silvicultural treatments to both hardwood and conifer stands on the ANF. Hardwood and softwood pulp from the ANF are similar in value, and have increased at a much slower rate in value than sawtimber values, and in 2004 averaged \$1.50 to \$2.00 per cord. Since the ANF is predominantly a hardwood forest, hardwood species dominate the pulpwood volume produced annually on the ANF.

Currently, approximately half of the ANF’s pulpwood made available is marketed. Demand for ANF pulpwood is driven by factors such as regional pulp mills, paper mills, and particle board plants, and has fluctuated since 1986. With current energy-related prices such as natural gas, heating oil, and propane increasing, it is anticipated that demand for fuelwood from the ANF will increase in the next decade.

There are no data that specifically address the current demand for timber originating from lands in Pennsylvania. Strauss et al (2000) completed an assessment of the economic impact of Pennsylvania's hardwood industry, pointing out that the sawmill sector plays the pivotal role in the industry, and the key limiting factor on the sawmill sector is the availability of timber (pp 51 and 52). There is a strong demand for ANF timber stumpage based on recent price trends and the extremely low level of "no-bid" timber sales on the ANF. Since 1986 (using price as an indicator), demand for ANF timber has increased dramatically, with the average real price (i.e., inflation has been removed) for black cherry and total sawtimber increasing more than 400 percent (Figure 3-17). The increase in total sawtimber values is driven primarily by the high value assigned to quality black cherry from the ANF. In conclusion, there is no indication of any need to change the 1986 Forest Plan's conclusion that the demand for ANF hardwood sawtimber exceeds supply.

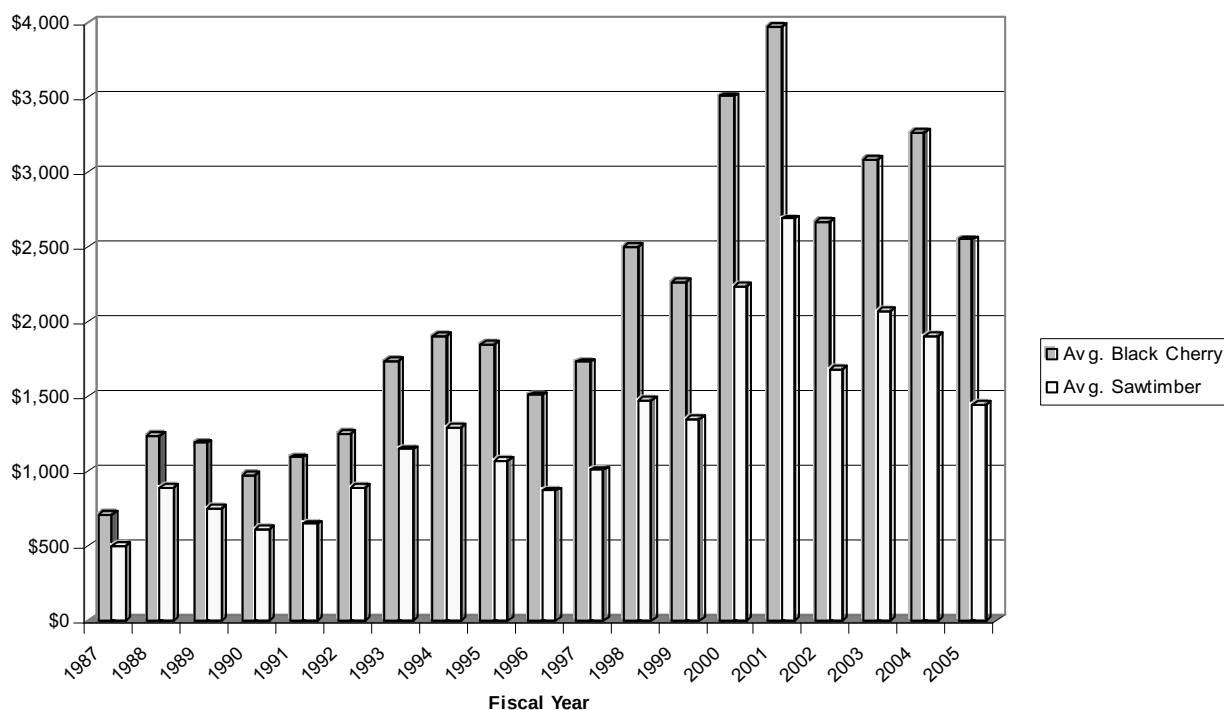


Figure 3-17. Average black cherry price (\$/MBF) and average sawtimber price (\$/MBF) adjusted for inflation, September 2005

Available growing stock

The ANF contains nearly 25 percent of the Nation's total inventory of black cherry sawtimber and a higher relative proportion of grade 1 sawtimber than private lands (Luppold unpublished 1997). Between 1989 and 2002, the largest increases in Pennsylvania inventory volume were observed in the Allegheny inventory region, which includes the ANF (McWilliams *et al.* 2004). The Allegheny inventory region contains the largest volume of red maple, black cherry, and northern red oak statewide.

Periodic inventories show that the ANF and surrounding forests have re-grown abundantly since the extensive clearcutting of the early 1900s. The following are highlights of 2004 FIA data for the ANF, surrounding four counties, and Commonwealth of Pennsylvania (Alerich *pers. comm.* 2006):

- Total volume of live trees on the ANF amounts to nearly 1.4 billion cubic feet, which is an average of 2,762 cubic feet per acre. This is well above 1,910 cubic feet per acre, the average for Pennsylvania. This amounts to over 30 percent more cubic volume per acre on ANF lands compared to the rest of Pennsylvania.
- Red maple and black cherry comprise 56 percent of the standing cubic volume on the ANF. Red maple and black cherry only comprise about 30 percent of the cubic volume in the rest of Pennsylvania.
- With an estimated 760 cubic feet per acre of black cherry, the ANF contains nearly one third more black cherry volume per acre than the surrounding four counties, and more than three times the cubic black cherry volume per acre found in the rest of the Commonwealth of Pennsylvania (200 cubic feet per acre).
- Average net volume of growing stock on the ANF increased from 2,344 board feet per acre in 1989 (USDA FS NFES unpublished) to 2,611 board feet per acre in 2004. The largest increase in per acre sawtimber volume occurred in the 15-16.9 inch diameter class.
- Black cherry is the leading species in sawtimber volume on the ANF, and comprises over one third of all growing stock sawtimber on the ANF. Red maple comprises the second most amount of volume, with 29 percent of the growing stock sawtimber volume. These two species comprise roughly 62 percent of all sawtimber volume on the ANF. Similarly, these two species comprise 52 percent of the sawtimber volume in the four counties surrounding the ANF.
- Black cherry thrives on the ANF, which contains more than five times the per-acre black cherry sawtimber volume as the Commonwealth (3,218 board feet per acre on the ANF versus 626 board feet per acre in Pennsylvania), and nearly fifty percent more per acre than the surrounding four counties (2161 board feet per acre).
- The diameter class with the greatest proportion of sawtimber volume on the ANF is the 21-29" class, followed by the 15-16.9" diameter class. The greatest proportion of sawtimber volume in the surrounding four counties sawtimber volume falls within the 15-16.9" diameter class. Pennsylvania's sawtimber is smaller yet, with 11-12.9" class containing the highest proportion of all the diameter classes.
- Sixty-three percent of the hardwood sawtimber on the ANF is classed as Grade 1 or 2, as compared to 53 percent of hardwood sawtimber in Pennsylvania classed as Grade 1 or 2.
- The ANF contains more than 2.5 times the volume of Grade 1 sawtimber per acre than forests across the Commonwealth of Pennsylvania.
- The ANF (1,564 board feet per acre) contains nearly seven times the average of Grade 1 black cherry sawtimber per acre estimated for the Commonwealth of Pennsylvania (233 board feet per acre). The surrounding four counties contain approximately 50 percent less Grade 1 black cherry sawtimber per acre (1,019 board feet per acre) than the ANF.

- Grade 1 Sawtimber volumes per acre for all species on the ANF increased from 1,331 board feet per acre in 1989 (USDA FS NFES unpublished) to 3,546 board feet of Grade 1 sawtimber per acre in 2004, or a nearly three-fold increase.

A comparison of 1989 (USDA FS NFES unpublished) and 2004 Forest Inventory and Analysis (FIA) data (Alerich *pers. comm.* 2006) for the ANF revealed that total standing volume per acre on the ANF has increased from an estimated 2,412 cubic feet per acre in 1989 to 2,775 cubic feet per acre in 2004.

Harvest volumes

Allowable Sale Quantity (ASQ) is the maximum amount of timber that can be sold in each decade covered by the forest plan from lands suitable for timber production. ASQ may increase from decade to decade where forests experience improved age class distribution and stocking over time, but declining flow from decade to decade is not allowed. It is usually converted into an average annual quantity. This “quantity” is generally expressed in million cubic feet (MMCF) and converted into million board feet (MMBF) of timber volume. The timber volume available for harvest varies by alternative based primarily on the amount of suitable timber land, silvicultural systems, and management intensity.

The 1986 Forest Plan identified a long-term sustained yield and an allowable sale quantity of 14.9 MMCF (94.5 MMBF/year). By 1991, ANF personnel recognized a need to re-evaluate the ability to achieve the 1986 Forest Plan harvest potential through 2005. A team of resource specialists initiated an analysis to better understand the inter-relationships, and identified thirteen factors interrelated with timber harvest capability believed to be impacting annual timber harvest program capability on the ANF (USDA FS 1995a).

These factors were grouped into the following general categories:

Unanticipated Natural Events and New Management Information

1. Gypsy moth infestation
2. Beech bark disease complex
3. Tornado damage
4. Landscape approach to old growth designation
5. Riparian area management
6. Tree mortality and decline detected in 1994

Technical Corrections

1. Errors in mapping management area acreages
2. Problems related to establishing and growing tree seedlings
3. Refining computer model (FORPLAN) projections
4. Underestimated lands physically not suited for commercial timber production
5. Underestimated timber harvest from pine stands and MA 1.0

6. Overestimated timber harvest from Management Area 6.2
7. Overestimated thinning harvest volumes

The result of this analysis (USDA FS 1995a), “Analysis of Timber Harvest Program Capability 1995 through 2005” (The THPC) estimated a maximum annual harvest level from 1995-2005 of 53.2 MMBF, though the long-term annual harvest level could be up to 77.1 MMBF if adequate tree seedlings develop in shelterwood seed cuts slated for final harvests.

Figure 3-23 shows the actual quantity of sawtimber and pulpwood sold during between 1986 and 2005 in MMBF. The 1986 Forest Plan estimated that during the first decade of the plan, the ASQ would consist of more pulpwood than sawtimber. In the second decade (beginning in 1995), the 1986 Forest Plan estimated a larger share of sawtimber in the ASQ. The THPC also estimated this capability for the 1995-2005 period as shown in Figure 3-18. The figure also shows several events that affected the ANF, including the 1985 tornado, oak salvage, Threatened and Endangered species plan amendment, and the mortality and Eastside litigations.

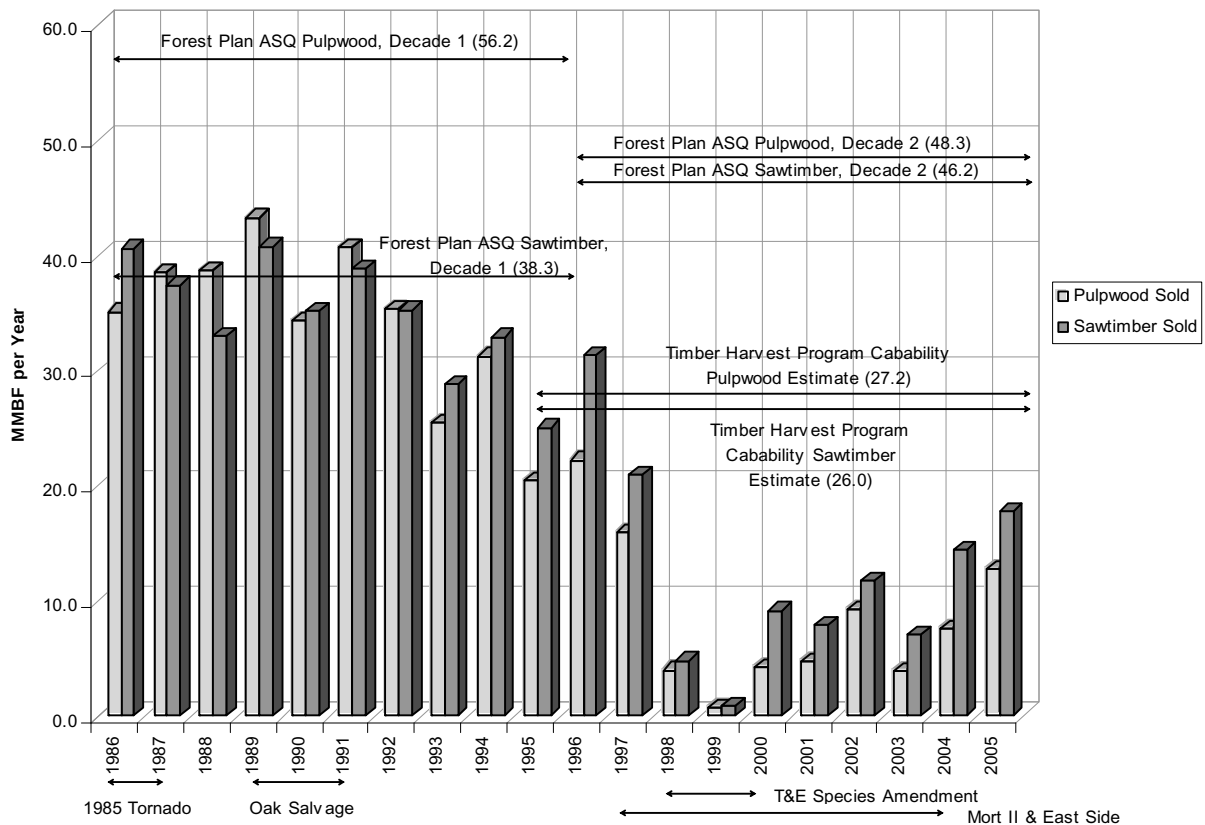


Figure 3-18. 1986 Forest Plan ASQ (1986-2005) and actual accomplishments (1986-2005) based on sales awarded

Table 3-104. Actual harvest activity accomplishments (1986 – 2005) compared to “1986 Forest Plan” and “Timber Harvest Program Capability Report” harvest volumes for 1986 – 2005

		1986 – 2005 Estimate (Acres)	Actual 1986 – 2005 Accomplishments		
Harvest Activity	1986 Forest Plan	THPC	Acres	% of 1986 Forest Plan	% of THPC
Final Harvest	67,000	33,043	28,487	43	86
Thinning	172,000	63,916	51,877	30	81
Selection (UEAM)	6,000	6,000	6,111	102	102
Shelterwood Seed	60,300	30,239	19,385	32	64

Total harvest activity accomplishments

The THPC also identifies acres of each type of harvest activity that will be necessary to achieve the identified harvest level and the desired future forest condition (see Table 3-104 for estimated and accomplished harvest activities). While the total final harvest acreage for 1986-2005 is only 43 percent of the 1986 Forest Plan acres identified for 1986-2005, it is 86 percent of the revised harvest acreage estimated in the THPC. Actual thinning acreage accomplished is 30 percent of the 1986 Forest Plan level and 81 percent of the THPC level. Selection harvesting is 102 percent of 1986 Forest Plan or THPC level, while shelterwood seed harvests are 32 percent of the 1986 Forest Plan harvest acreage and 64 percent of the THPC estimate.

Lands tentatively suitable for timber production

One decision of the forest plan revision is the identification of land that is suitable for timber production. This identification consists of two steps. The first step, discussed in this section, is the identification of lands that are available and technically suitable for timber production. This is identified as the lands tentatively suitable for timber production. This is a starting point for the second step (discussed under effects of alternatives) in which the alternatives identify further reductions in lands suitable for timber production based on allocation of management areas.

To determine the lands tentatively suitable for timber production, the following categories of lands are sequentially subtracted from the total forest acres:

1. All lands that are not forested, such as water, grasslands, and lands developed for other uses
2. Forested lands withdrawn from timber production by Congress, the Secretary of Agriculture, or the Chief of the Forest Service
3. Forest lands not capable of producing industrial wood
4. Forest lands that cannot be regenerated with new trees within 5 years

5. Forest lands where technology is not available to ensure timber production without irreversible damage to soil productivity or watershed conditions
6. Forest lands for which there is inadequate information to make a determination

During the analysis for the 1986 Forest Plan, there were an estimated 510,530 acres on the ANF, of which 463,143 acres were considered tentatively suitable for timber production (USDA-FS 1986a, FEIS. Appendix B, pp. 25-26). Table 3-105 displays a comparison between the estimation for the 1986 plan and the LRMP.

Table 3-105. Lands tentatively suited for commercial timber harvest, 1986 and LRMP

Description	1986 Acres	Revised Acres
National Forest System Lands	510,530	516,843
Water	(8,305)	(11,169)
Non-forested Land	(22,561)	(42,191)
Forest Land Withdrawn from Timber Production	(15,621)	(34,536)
Forest Land Not Capable of Producing Crops of Industrial Wood	0	0
Forest Land Physically Not Suited because restocking within 5 years cannot be assured	(450)	(20,520)
Forest Land Physically due to irreversible damage that could occur from timber operations	(450)	0
Forest Land- Not Suited due to Inadequate Information	0	0
Tentatively Suitable Forest Land	463,143	408,427

The new analysis identified 408,427 acres as tentatively suitable for timber production. The differences between the estimates for the 1986 plan and the new plan are based on a number of factors. Improved mapping techniques (GIS) have resulted in more accurate identification, mapping, and calculation of tentatively unsuitable lands. Other major changes are an increase in non-forested acres, an increase in lands withdrawn from timber production, and identification of lands physically unsuited.

The largest change is in the identification of non-forested lands based on better mapping of non-forested lands, forest roads, oil and gas well pads, roads and other facilities. This increase in the lands developed for non-forest use was anticipated in the 1986 plan. The increase in forestlands withdrawn from production is a change in the interpretation of the National Recreation Area (NRA). The 1986 plan did not assume that this area was congressionally withdrawn from timber production (although the ANF did identify it as inappropriate for timber production); the LRMP assumes that the NRA was congressionally withdrawn.

Finally, additional field inventory and data analysis has identified an additional 20,000 acres where the technology and knowledge do not exist to restock lands within 5 years of final harvest. Further discussion about the identification of lands tentatively suitable for timber production can be found in Appendix B (pp. B1-B7).

Special forest products

Special Forest Products (SFPs) are defined as “products derived from biological resources collected in forests, grasslands, and prairies for personal, educational, commercial, and scientific use” (USDA FS 2001b). Special forest products exclude sawtimber, pulpwood, cull logs, small roundwood, house logs, utility poles, minerals, animals, animal parts, insects, worms, rocks, water, and soil. Use of these products is diverse, but generally falls under five broad areas: foods, herbs, medicinals, decoratives (including floral greenery and dyes), and specialty items (including aromatic oils and certain value-added wood products). The ANF seeks to provide a variety of special forest product collection opportunities and manage these opportunities based on the appropriate analyses and monitoring of species to ensure their sustainability. The current demand by type or amount of special forest products on the ANF is largely unknown.

Introduction to effects

Timber management, and associated forest products, on the ANF is primarily influenced by the allocation of lands to different management area prescriptions. Some areas on the ANF are assigned prescriptions that allow or emphasize timber harvest, and others are not. Some of the management areas are considered not suitable for managing timber, and some include lands that are both suitable and unsuitable. Prescriptions with suitable lands also have desired conditions for vegetation that may affect the harvest methods and silvicultural systems used to achieve them. The alternatives proposed in this FEIS have different allocations of management areas, and the range of alternatives can be used to show relative differences in timber production and harvest methods used based on those allocations.

Since the vegetation condition (primarily from forest health impacts) on the ANF has changed in many areas since 1986, benchmark analysis was used to define new maximum levels of capability. See Appendix B for a discussion of benchmarks.

In this section, the effects of the alternatives on forest products are described for each of the following:

- Acres of land suited for timber management by alternative
- Annual ASQ (cubic and board feet) by alternative
- Changes in other harvest opportunities

Scope of analysis

The affected areas for direct and indirect effects to forest products and special forest products are lands administered by the ANF. The affected areas for ASQ are the lands classified as suitable for timber management under each alternative.

Effects common to all alternatives

Special forest products

The special forest products program will be implemented by project level decisions. Individual project level analysis will ensure special forest products collections remain at sustainable levels.

Effects by alternative

Lands suitable for timber production

The ability to provide timber products from the ANF is a function of the land base considered suitable for timber production. Lands considered unsuitable in Table 3-106 may still have unscheduled timber harvests that do not contribute towards ASQ.

As described previously in the affected environment, 408,427 acres are identified as tentatively suitable for timber production. This part of the analysis presents the determination of lands suitable for scheduled timber production based on management area designations and land use allocations in each alternative, which further defines appropriateness for sustained, scheduled timber production.

Table 3-106. Suitable land for timber production

Category		Acres			
Tentatively Suitable Forest Land		408,427			
Forest Land Not Appropriate for Timber Production by Alternative ¹		Alt. A	Alt. B	Alt. Cm	Alt. D
Forest Land Not Appropriate for Timber Production	MA 5.2 Proposed Wilderness Study Areas	0	0	11,577	13,641
	MA 6.3 Buzzard Swamp Wildlife Management Area	479	479	479	479
	MA 7.1 Developed Recreation Areas	300	280	280	31
	MA 7.2 Remote Recreation Areas	0	4,310	8,417	27,493
	MA 7.3 Interpretive Recreation Area	0	3,077	0	0
	MA 8.1 Wild and Scenic River Corridor	0	5,662	5,662	5,640
	MA 8.4 Historic Area	172	172	172	172
	MA 8.6 Kane Experimental Forest Expansion	0	1,530	1,530	1,530
	MA 9.1 Managed with Minimal Investment	871	0	0	0
	Corridor along Wilderness, Remote, and Class A Wild Trout Streams Streams ²	0	1,255	1,255	1,255
Total Forest Land Not Appropriate for Timber Production		1,822	16,765	29,372	50,241
Unsuited Forest Land		110,238	125,181	137,788	158,657
Total Suitable Forest Land (MA 1.0, 2.1, 2.2, 3.0, and 6.1)³		406,605	391,662	379,055	358,186

¹ The acreages displayed do not include acreages previously removed as being non-forested, withdrawn, or physically not suited for timber management. These acreages are the net increase by acreage in areas considered inappropriate for timber management.

² Includes the area within 200 feet of Wilderness Trout Streams, Remote Trout Streams, and Class A Wild Trout Streams as defined in the forestwide Soil and Water standards and guidelines.

³ Suitable lands within these management areas are limited to those that have been identified as tentatively suitable for timber production (forest land that is not withdrawn, able to regenerate seedlings within 5 years of final harvest, will not result in irreversible resource damage to soil productivity or watershed conditions, and is cost efficient in meeting multiple use objectives).

Suited lands consist of physically suited lands in MAs 1.0, 2.1, 2.2, 3.0, and 6.1 in all alternatives. Alternative A also includes MA 6.2 as part of the suited land base. All other management areas are considered to be inappropriate for sustained, scheduled timber production, however most permit salvage of timber and reforestation activities in response to tree mortality. Alternative A results in the largest proportion (79%, or 406,603 acres) of the ANF (516,843 acres) being considered suitable for scheduled timber production, followed by Alternatives B and Cm. Alternative Cm results in 73 percent (379,053 acres) of the ANF being considered for scheduled timber production. Alternative D results in the smallest proportion (67%, or 348,303 acres) of the ANF being considered suitable for sustained, scheduled timber production.

Allowable sale quantity (ASQ)

Table 3-107 displays the ASQ associated with each alternative. These values are expressed in million cubic feet (MMCF) and millions of equivalent board feet (MMBF) of timber volume. Alternatives A and B have the highest ASQ, followed by Alternative Cm. Alternative D has the lowest ASQ, less than half that of any of the other alternatives. These values compare to the ASQ of 14.9 MMCF/year (94.5 MMBF/year) in the 1986 Forest Plan, and the harvest capability of 53.2 MMBF identified in the THPC (USDA FS, 1995).

The long-term sustained yield (LTSY) is defined as “the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple use objectives” (USDA FS 1982, CFR 219.3). All four of the alternatives provide for a non-declining flow of timber harvest volumes at or less than the LTSY. All alternatives have an ASQ for decades 1 through 15 that equals the LTSY.

Table 3-107. ASQ and LTSY by alternative

Allowable Sale Quantity		Alternative A	Alternative B	Alternative Cm	Alternative D
MMCF	Decade 1	10.9	10.3	8.9	4.3
	Decade 2	10.9	10.3	8.9	4.3
MMBF	Decade 1	66.5	63.1	54.1	26.3
	Decade 2	66.5	63.1	54.1	26.3
Long-Term Sustained Yield					
MMCF		10.9	10.3	8.9	4.3

Product mixes

It is anticipated that Allegheny and upland hardwoods, with lesser amounts of northern hardwoods and a small amount of oak forest types, will comprise most of the volume harvested in the first two decades of implementation in all alternatives. Actual project level decisions will determine what forest types will be harvested. Nonetheless, it is anticipated black cherry will comprise a substantial portion of harvest volumes in the next few decades in all of the alternatives. Some shift in forest types harvested, however,

can be anticipated in future decades on the ANF to encompass more oak, upland, and northern hardwood types. Alternative A and B will result in similar harvest levels of Allegheny and upland hardwoods harvested, followed by Alternative Cm. Alternative D will harvest the least overall volume annually, and consequently harvest the least amount of Allegheny hardwoods.

Harvest on lands unsuitable for timber production

In addition to timber harvest from suitable lands that have scheduled timber harvests, it is anticipated that there will be some vegetative treatment, including harvest activities on lands that are not suitable for timber production. This activity will be limited to situations where removal of timber is needed to meet the objectives and desired conditions of management areas that do not have scheduled harvest or on technically unsuitable lands within management areas that do schedule timber harvest. Volume removed from lands unsuitable for timber production does not contribute to volume in the ASQ and may be removed in addition to the ASQ.

Emergency cutting and removal of trees would be allowed in all alternatives and in all management areas to contain emergencies (e.g. fire, insect infestation, or other hazards) that are likely to spread to other ownerships.

Beyond emergency situations, only four management areas (MAs 5.1, 5.2, 8.3 and 8.5) would not allow some vegetative treatments for other resource purposes. Of these management areas, only the acreage allocated to MA 5.2 changes by alternative, so that opportunities to advance other resource benefits through vegetative treatments would be more limited in Alternatives Cm and D as compared to A and B, as there are recommended wilderness study areas in these two alternatives. The difference is rather small.

In the remaining management areas that are unsuitable for timber production (MAs 6.3, 7.1, 7.2, 7.3, 8.1, 8.2, 8.4, 8.6, and 9.1), vegetation activities that can include harvest for other resource purposes are allowed. Reasons for such harvest activities include wildlife habitat improvement, maintenance of facilities, administrative use, and addressing forest health concerns. These vary based on the direction for the individual management area contained in Part IV of the LRMP. The overall percent of land available for harvest for other resource purposes comprises 97 percent of the ANF in Alternatives A and B, 95 percent in Alternative Cm, and 91 percent in Alternative D.

Salvage timber harvest

Salvage timber harvest that allows the removal of trees affected by wind events, fire, insects, diseases or other disturbances that kill or damage trees is generally allowed over most of the ANF in all alternatives. Based on past experience, there is a high likelihood of some salvage activities during the period affected by the plan. Salvage harvest volume may contribute to the ASQ if the volume removed is on lands suitable for timber production.

Only management areas 5.1, 5.2, 8.2, 8.3, and 8.5 do not allow salvage harvest activity. Salvage harvest activity is a suitable management activity on 93 percent of the ANF in Alternatives A and B, 91 percent in Alternative Cm, and 90 percent in Alternative D. Direction associated with salvage harvest activities is

identified on a forestwide basis in Part III of the LRMP and direction pertinent to individual management areas is identified in Part IV.

Special forest products

While known collection of items such as berries, leeks (*Allium sp.*), and ground-pine (*Lycopodium sp.*) occurs, little is known about potential harvest impacts. Depending on the species, FS management activities may have beneficial and/or detrimental effects to SFPs. For example, berry-producing shade intolerant species may be benefited by vegetation management activities. Reforestation activities such as fencing benefits species impacted from herbivory. Shade tolerant species may be impacted by vegetation management activities. These benefits and/or impacts may also vary in the short term versus the long term. Effects from management activities on SFPs would be similar to effects from earth disturbing activities discussed under the heritage and non-native invasive species (NNIS) sections.

Alternative A does not have specific SFP prohibitions for SFP collection by management area, however, MA 5.1 Wilderness and MA 5.2 Wilderness Study Area would be excluded from areas that allow SFP collection. Alternatives B, Cm, and D would follow new direction contained in the LRMP that identifies specific management areas in which personal and/or commercial collection of SFPs may occur. Commercial collection of SFPs would be suitable in any management area except MAs 5.1, 5.2, 7.1, 7.2, 7.3, 8.2, 8.3, 8.4, 8.5, and 8.6. Personal collection of SFPs would be suitable in any management area except MAs 5.1, 5.2, 8.4, 8.5, and 8.6. New direction for SFPs is as follows:

- Collection of special forest products may be authorized provided it is consistent with management area emphasis and may not threaten or diminish the character or purpose for which the management area was designated. Requests shall be evaluated for compliance with applicable authorities and sustainability analyses.
- Experimental propagation areas will be designed and implemented for high demand species in appropriate management areas.

Cumulative effects

The affected areas for cumulative effects on timber supply are forested lands in the counties (Elk, Forest, McKean, and Warren) surrounding the ANF. This area includes lands administered by both the Forest and other owners. Figures for the entire Commonwealth of Pennsylvania are referenced for an expanded context, but activities on the ANF have little effect the statewide markets. The timeframe is the next 2 decades as it is a realistic time frame to predict reasonably foreseeable activities.

Timber availability and harvest

The 1989 inventory (Alerich 1993) of Pennsylvania's forested ecosystem revealed the eight county Allegheny Region, which includes the ANF, contains one-fifth of the State's timberland area, but more than one-fourth of the State's sawtimber inventory volume. At that time, Pennsylvania had the largest inventory of cubic hardwood growing stock nationally, and it was expanding at twice the rate at which volume was being removed. About one-

fourth of Pennsylvania's forest land is publicly owned. National Forest land constitutes 3 percent of the forest land in the statewide (Pennsylvania Forestry Association, undated).

In the northeastern United States, pulpwood production increased less than 1 percent between 1991 and 1996, however it accounted for 30 percent of the region's total roundwood output (Wharton and Whidman 2001). Historical pulpwood markets in the ANF market area and the north-central region of Pennsylvania have been papermills. Those were located in Erie, Tyrone, Johnsonburg, and Lock Haven, PA. The mills in Johnsonburg and Tyrone are still in operation, while the other two are not. Two satellite chipping operations (one in the ANF market area, Kane, PA the other near Clearfield, PA) also began in the 90s that supported the Johnsonburg papermill facility. In the early 1990s, a particleboard factory and then a medium density fiberboard factory began operations within the immediate ANF market area. During the early 1990s, hardwood pulpwood from the ANF constituted between 30 and 40 percent of the raw material for the particleboard plant (Durner *pers. comm.* 2005). A small wood-pellet product plant exists in Youngsville, PA. Future growth and development of the wood-pellet industry in the Allegheny Market Area will likely hinge on heating fuel prices (oil and natural gas) and the pace of conversion to this heating technology. It may be more readily adaptable to rural areas rather than metropolitan areas.

McWilliams *et al.* (2004) reported the total sound-wood volume on forestlands statewide increased from 27.5 to 33.7 billion cubic feet, a 23 percent increase from 1989 to 2002. The total volume of sawtimber on timberland increased from 72.8 billion board feet in 1989 to 86.3 billion board feet in 2002, an increase of 18 percent. Except for sugar maple, Pennsylvania's top 10 species increased significantly in sawtimber volume. This supports the conclusion that Pennsylvania's forests are maturing and accumulating older, high value trees. It can be concluded that Pennsylvania contains more timber today than at any time since the late 1800s.

Harvest rates on private lands, and associated wood products are anticipated to continue, particularly as forests on private lands achieve economic maturity and stumpage prices remain high (Jacobson *pers. comm.*, 2005). Forest products from the ANF will contribute towards a sustainable supply of wood products in the immediate region. Alternative A will most contribute the most, followed by Alternatives B and Cm, and Alternative D contributing the least. Therefore, Alternative D would result in the potential for disproportionate harvest volumes for regional industries coming from private lands as noted by Strauss (2004). Along with wood products from private lands, wood products resulting from forest management activities on the ANF will contribute to regional wood product industries. See the cumulative effects section of forest vegetation (3.3.1) for additional cumulative effects discussion on forest management in the cumulative effects area.

Special forest products

It is assumed that Forest Service management activities will remain fairly constant over the next two decades, though the types and amounts of various activities will vary by alternative. However, due to uncertainties in the current amount of SFPs that exist or are being collected it is difficult to estimate the impacts for future trends. As national interest in SFPs increases (Emery and McLain 2001), it is assumed that interest will also increase on the ANF.

Activities most likely to result in cumulative effects from Forest Service management activities include vegetation management, road management, gravel pit development/expansion, motorized recreation – intensive use areas and trails, equestrian use areas and wildlife opening creation. Cumulative effects analysis can be seen for these activities in other sections of Chapter 3. Generally, the overall trend of these activities is an increase under Alternatives A, B, and Cm and a level similar to the past 20 years of activity in Alternative D.

The primary non-federal activities that occur within the ANF proclamation boundary that may impact SFPs include timber harvest, residential development, road construction and oil and gas development. Oil and gas development on both private and Forest Service administered land is predicted to have the greatest amount of ground disturbance and the greatest increase in activity in both the short and long term.

The cumulative effect to SFPs from federal and non-federal activities is an increase in land disturbed leading to potential decrease in SFPs not amenable from such disturbance. Project analyses will evaluate the effects of ground disturbing activities and collection for SFPs. Commercial permits to collect SFPs require a sustainability analysis and a project level decision.

3.4.7 Economics

Changes to this section since the DEIS are minor. All economic estimates for the alternatives have been adjusted based on technical changes made in the modeling and information for alternative Cm is presented. Some additional material describes Secure Rural Schools payments and recreational contributions, including the contributions of hunting and fishing. Most economic information is now presented for the midpoint of the first decade of the plan.

Affected environment

The discussion in this section begins with a brief economic history of the ANF economic region. The ANF economic region is defined as the four counties in Pennsylvania where the ANF is located (Elk, Forest, McKean, and Warren Counties). This is followed by a summary of major trends in employment, income, and payments to local governments that have affected the ANF economic region, hereafter referred to as the ANF region (see Figure 3-24). A basic description of the economies of these four counties is given followed by a discussion on each county within the region that highlights that county's important economic sectors, basic economic data and trends for employment and income, and payments to local governments.

Brief economic history of the ANF economic region

Although the portage route from Lake Erie to Conewango Creek to the Allegheny River was the initial route of European exploration of the Ohio River valley in 1749, it was quickly bypassed in favor a shorter connection through French Creek to what is now Franklin, PA. The bypass of this region from major transportation and trading routes is a primary reason why the ANF economic region never developed any major metropolitan areas. Instead, the story of this economic region is one primarily initiated and sustained by development of its natural

resources. The region has struggled with the cyclical nature of this economic activity and experienced modest success in diversification. This challenge continues today.

The initial economic development of the ANF economic region in the early 1800s was based on the harvest of timber (primarily white pine) along the major rivers of the region (Allegheny and Clarion). From small water-powered sawmills and logging camps along these rivers, large timber rafts floated downriver to other sawmills or markets as distant as Pittsburgh, Cincinnati, or New Orleans. This contributed to the establishment of initial settlements along these rivers such as Warren, Tidioute, Tionesta, and Ridgway.

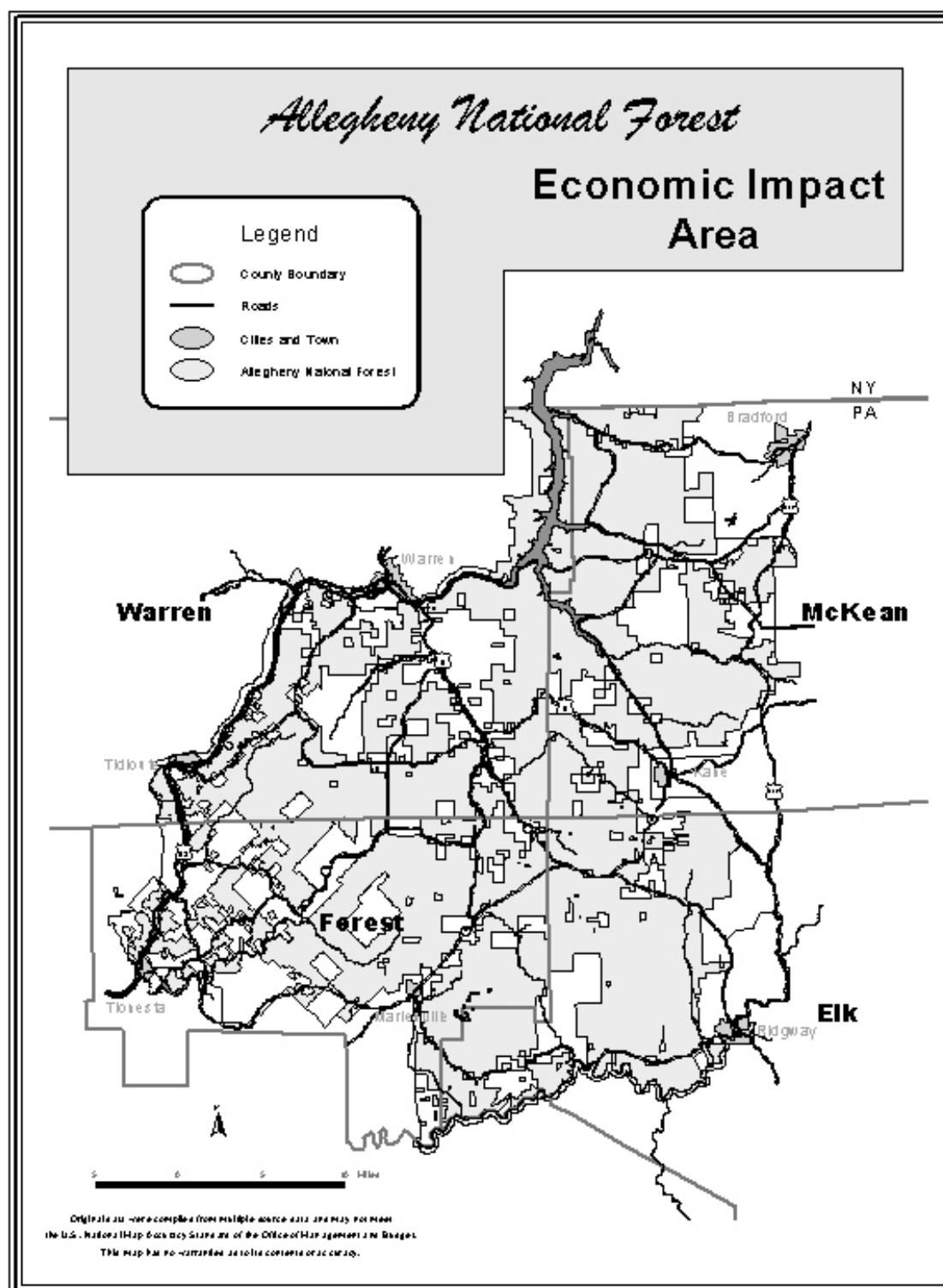
In 1859, the first commercial oil well was drilled at Drakes Well in Titusville to the west. Shortly thereafter, the second commercial oil well was drilled at Tidioute. During the initial boom of oil development that followed, the Cherry Grove, Balltown, Cooper, and Kane oilfields within the current ANF were the major centers for the world's production of oil. Oil exploration, development, transportation, and refining had a huge impact on the development of the ANF economic region and contributed substantially to the wealth and importance of the region's population centers such as Tidioute, Warren, Bradford, and Tionesta. However, this development had an inherent cyclical nature with periods of boom (high oil prices and economic prosperity) and bust (low prices and economic decline).

In the late 1800s, railroad access expanded the opportunity to access the timber and oil wealth of the ANF economic region. Railroad connections contributed to the development of Sheffield and Kane. In addition to the harvest of timber for lumber products, the demand for the region's timber was greatly accelerated by the tanning industry's need for tannin from hemlock and later the wood chemical industry that converted timber into various industrial chemicals. The result was near complete removal of the existing forest on the Allegheny Plateau in the early twentieth century.

With the creation of the ANF in 1923 and the emergence of automobile transportation, the ANF economic region began to further diversify in two major ways. The first was the creation of a broader range of manufacturing activities that began with processing of local natural resources, primarily lumber and oil, but also diversified into the manufacture of a variety of other products. The second was the emergence of the region as a summer tourism destination for families seeking escape from urban and small city environments to enjoy the forest river environment surrounding the ANF. To this day the number of "camps" and summer homes hosts a substantial influx of population during the warmer months.

Much as the earlier economic cycles disrupted various industries in the ANF region, the region now struggles with the decline of manufacturing, part of a broader national economic transformation. Increasing tourism opportunities, particularly destination tourism fostered by efforts such as the Pennsylvania Wilds initiative, are widely seen as a potential economic opportunity to further diversify the region and offset some of the declines in manufacturing. It is also recognized that even today, as it was throughout the economic history of this region, the use of the region's inherent natural resources, primarily oil, natural gas, and timber, continues to provide substantial basic economic activity for the region.

Figure 3-19. ANF economic region



Trends in employment

Employment as used throughout this section is a measure of both full- and part-time jobs. As the section on the Social environment indicates, the ANF economic region has had stable or decreasing populations since about 1970. Over this same time period, the ANF economic region has experienced periods of employment growth and decline similar to the national economy. However, periods of rapid growth in employment in the national or Pennsylvania economy such as the 1980s and 1990 brought only small increases in employment to the ANF economic region. Employment in Pennsylvania increased by nearly 24 percent from 1980 to 2000, while employment in the ANF economic region increased by only 8.3 percent. Periods of stagnation and decline in the national or Pennsylvania economy tend to produce more substantial employment declines in the ANF region. From 2000 to 2003, Pennsylvania experienced a slight decline in employment of 0.05 percent, but the ANF economic region experienced a decline of nearly 5 percent over the same period.

Figure and Figure show the changing composition and level of employment from 1970 to 2000 for both the ANF region and Pennsylvania. In both the ANF region and Pennsylvania, the primary resource husbandry sectors of agriculture, forestry, and fishing have experienced some increases in both absolute employment and the share of total employment from 1970 to 2000. Mining has declined in both total numbers and share of total employment in both the Pennsylvania and the ANF region, although it remains a more important employment sector for the ANF region than for Pennsylvania. Manufacturing employment in both absolute numbers and share of total employment has declined in both Pennsylvania and the ANF region. From 1970 to 2000, manufacturing employment in Pennsylvania declined by 38 percent, while the ANF region experienced only a 14 percent decline. Thus in 2000, manufacturing continues to account for nearly 30 percent of the jobs in the ANF economic region, while it accounted for 14 percent of the jobs in Pennsylvania. Wholesale and retail trade has grown in both the ANF region and in Pennsylvania where it comprises between 18-20 percent of employment. Finance, Insurance, and Real Estate jobs have increased substantially in Pennsylvania from 1970 to 2000, but this sector has been almost stable as an employer in the ANF region. From 1970 to 2000, jobs in the Service sector have increased by almost 250 percent in Pennsylvania. While Services jobs have also increased by nearly 200 percent during the same period in the ANF region, Services comprise roughly a quarter of the jobs in the ANF region as compared to a third in Pennsylvania. Finally, government jobs have increased by roughly 10 percent in Pennsylvania, but by only 1 percent in the ANF region from 1970 to 2000.

It is clear that the basic resource husbandry sectors of agriculture, forestry, fishing, and mining remain important to both Pennsylvania and the ANF region even though they provided only about 1.1 to 2.5 percent of the total employment respectively. As the economic history of the ANF region suggests, increased demand and opportunity for growth in these basic sectors could lead to a modest increase in recent employment trends in these sectors, declines in demand would lead to contractions.

Figure 3-20. Employment by major sector, Pennsylvania

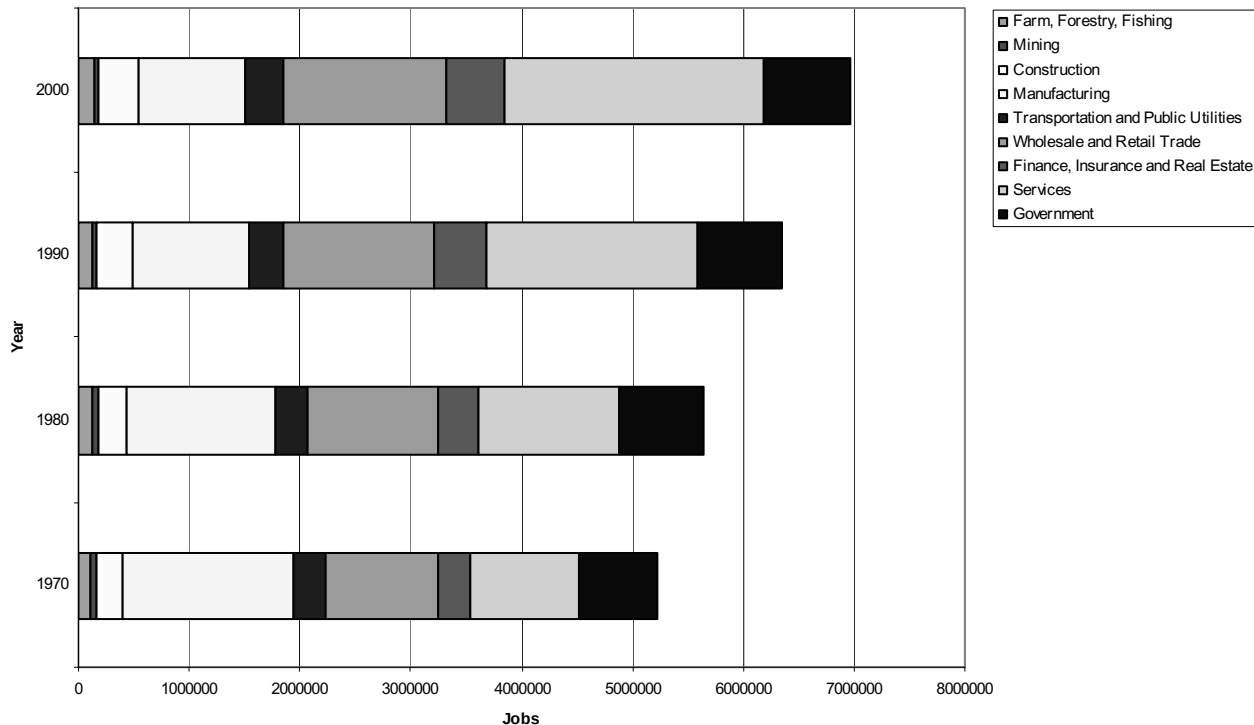
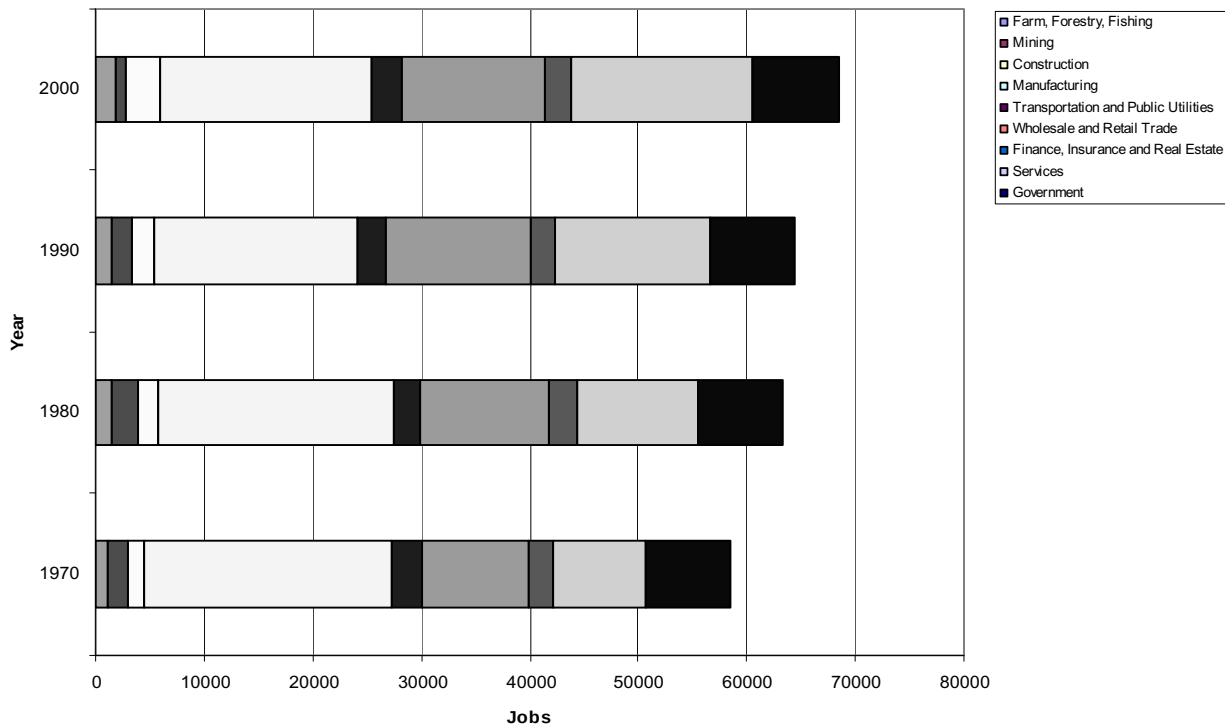


Figure 3-21. Employment by major sector, ANF Region



Source: US Bureau of Economic Analysis 2006

However, manufacturing employment and the ability of the ANF region to continue to retain this employment appears to remain the key for the near future. The region's oil and gas and timber resources provide raw material supply for part of this industrial base. Manufacturing within the ANF region is far broader than just petroleum or timber based industries. Processing of a variety of different products, such as fabricated metals, are not directly dependent on the region's natural resources. The ANF region has done better than Pennsylvania in retaining this manufacturing employment and this sector continues to provide one third of the ANF region's employment. However, decline in this sector continues and the loss of jobs in this sector will pose a serious challenge for the region.

The nature of the ANF region as a rural economy and the lack of major urban or suburban areas probably accounts for the lesser share of employment in Finance, Insurance, and Real Estate and Services. Relative to Pennsylvania, where Finance, Insurance, and Real Estate have experienced rapid growth in employment, the ANF region has lagged substantially. In the Services sector, the ANF region has had substantially increased employment, but not at a rate comparable to Pennsylvania. In the modern economy, with internet and phone access and driving times of three hours or less to the urban areas of Erie, Buffalo, Pittsburgh, and Cleveland, these services can be easily found outside of the ANF region.

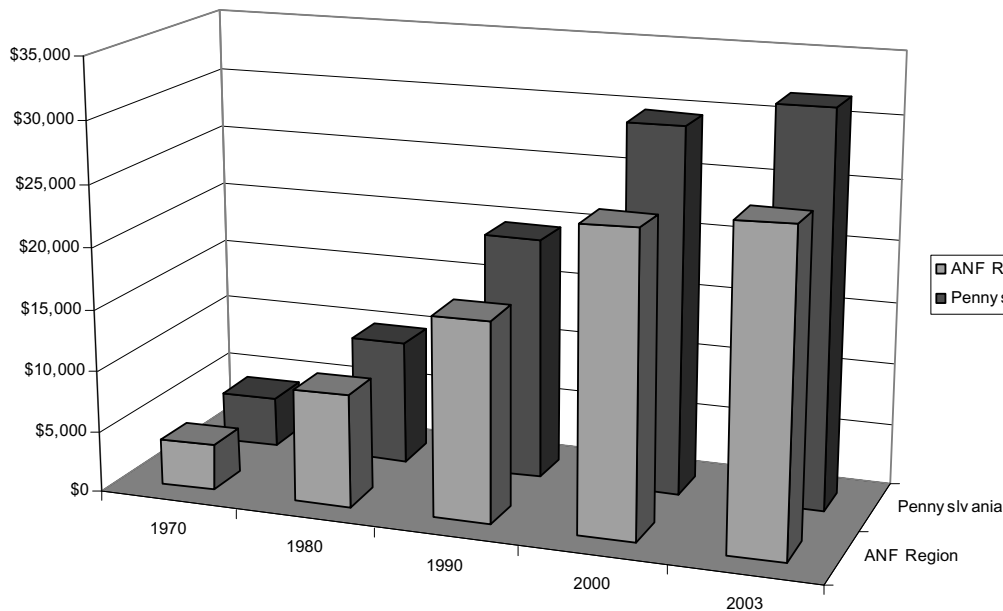
The ANF region has done better at building and retaining employment in wholesale and retail trade. However, nearly all of this employment is in retail trade. As the ANF region is distant from major transportation routes and markets, it lacks a comparative advantage for wholesale trade. Retail trade within the ANF region is generally characterized by small to moderate sized businesses. With the increase of online internet retailers and major large diversified retail establishments, the ANF region will face a further challenge to retain employment in this sector.

Although federal and local government employment increased in the ANF region until 2000, government employment from 2001 to 2003 has declined at the state and local level with a modest increase in federal government employment. Federal and state government employment provides important stability to the ANF economic region. Local government employment is generally sustained by local taxes, and if employment and income prospects are not increasing, it is unlikely that local government employment can increase.

Data for this section was derived from the regional economic information system (REIS) of the US Bureau of Economic Analysis, 2006.

Trends in income

In the growth of personal income, the ANF region has experienced a similar pattern to that of employment. During periods of personal income growth, the ANF region has been able to increase comparably, but in periods of decline personal income has declined more sharply. As shown in Figure, average per capita personal income in the region has generally been less than Pennsylvania. However, since 1970 this gap has increased. From 1970 to 1980, the ratio of average per capita personal income in the ANF region to the Pennsylvania average was about 90 percent. By 1990, this ratio had declined to 83 percent and in 2003 was slightly less than 80 percent.

Figure 3-22. Per capita personal income

The composition of personal income has changed over the period from 1970 to 2003, with transfer payments, especially for retirement, providing an increasing percentage of the source of personal income. In the ANF economic region, these transfer payments comprise almost a quarter of sources of personal income in 2003. For Pennsylvania, transfer payments accounted for 17.4 percent of personal income in 2003. The share of personal income from rents, dividends, and interest has also risen from about 13 percent to 16 percent in both the ANF region and Pennsylvania. The remaining shares of personal income primarily wages and salaries and proprietors income have been correspondingly reduced over this same period and now comprise about 60 percent of the personal income sources for the ANF region and 66 percent for Pennsylvania. This is consistent with the overall trend of an aging population described in the social section of the FEIS. As the ANF region's population ages, it becomes increasingly reliant upon transfer payments as a source of income.

Among the various economic sectors, it is clear that certain sectors provide higher earnings per job than others. Average earnings in the ANF region were approximately \$30,000 per job in 2003 (Center for Rural PA 2006) as compared to nearly \$38,000 for Pennsylvania. Sectors with earnings above this average in all of the reportable four counties included Utilities, Manufacturing, Wholesale trade, Company management, and Government. Sectors with average earnings below this average included: Agriculture, Forestry, and Fishing; Construction; Retail Trade; Transportation and Warehousing; Administrative and Waste Services; Educational Services; Health Care, and Social Assistance; Arts, Entertainment and Recreation; Accommodation and Food Services and Other Services. Jobs in Accommodations and Food Services; Arts, Entertainment, and Recreation; Administrative and Waste Services; Real Estate; and Agriculture, Forestry and Fishing averaged less than \$15,000 in earnings per job. These average earnings are based on industry earnings divided by the number of full- and part-time jobs, so economic sectors with large amounts of part-time workers will have a lower average.

Data for this section was derived from the regional economic information system (REIS) of the US Bureau of Economic Analysis, 2006.

Trends in payments to local governments

The Twenty-Five Percent Fund Act (P.L. 60-136), passed in 1908, provided that 25 percent of the receipts of each national forest would be returned to the states for the benefit of public schools and roads in the counties in which the national forest is located. For the ANF, the value of receipts is nearly completely correlated with the price of timber and the quantity of timber sold. Over the past twenty years, fluctuations in both these prices and the quantities of timber harvested made the 25 percent fund a source of local government instability rather than stability for many communities near National Forests. For that reason, Congress passed the Secure Rural Schools Act in 2000 (P.L. 106-393). This Act provided that for each fiscal year up to 2006, each state could receive payments based upon the high three year average of payments that had previously been received under the 25 percent fund. The Act also provided that between 80-85 percent of the payments would be distributed in a manner similar to the 25 percent fund distribution for public schools and roads and that the remaining amount would be available for use on Title II and Title III projects. Title II projects are special projects on federal lands and Title III projects are specific special projects under county jurisdiction. Counties have the option of choosing either the 25 percent fund basis of payment or the payment under the Secure Rural Schools Act.

In Pennsylvania, these funds have been distributed through the states to the counties, school districts, and townships for these functions. Townships receive funds and manage these funds for road projects, school districts for public education and counties for Title III projects of the Secure Rural Schools Act.

Figure displays the trend of payments to local governments in nominal dollars for each county and the entire ANF region. The figure demonstrates the rapid rise in the 25 percent fund payments that began in the late 1980s with rising timber prices and harvests on the ANF. This pattern continued until the late 1990s when timber harvests on the ANF dropped

substantially in 1999 and 2000. In 2001, Forest County opted for the Secure Rural Schools payment rather than the 25 percent fund. In 2003, the other three counties also opted for the Secure Rural Schools payment. All counties remain under Secure Rural School payments at this time. For the future, there remains uncertainty as to whether or not the Secure Rural Schools Act will be renewed or whether the level of payments will continue.

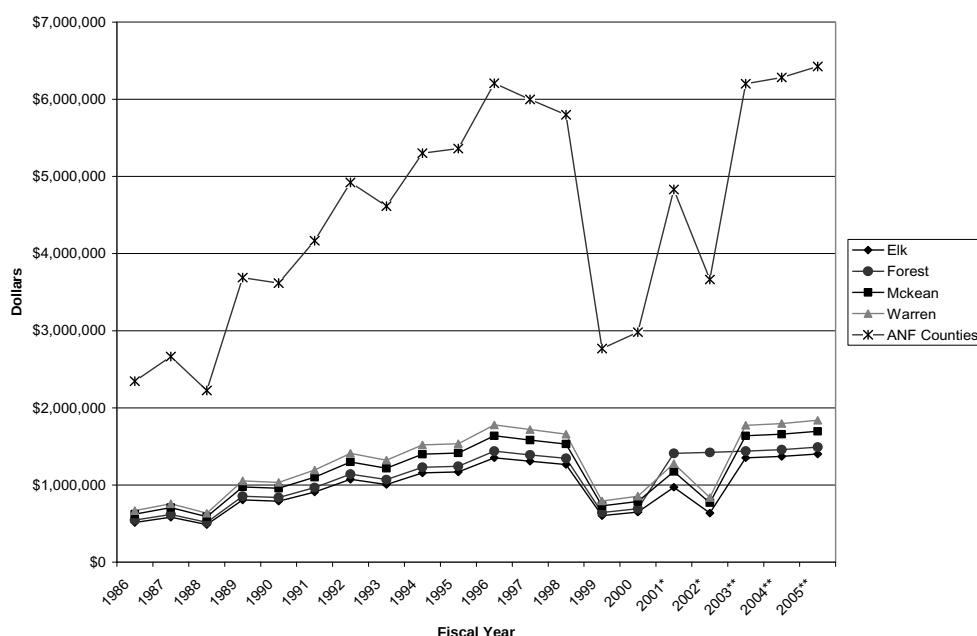


Figure 3-23. Payments to local governments

* Forest County under Secure Rural Schools Act

** All Counties under Secure Rural Schools Act

Economic characteristics of the four counties

Table 3-108 displays several basic economic characteristics of the four counties that comprise the ANF economic region. The table presents basic information on land used, population, employment, income, and payments to local governments. It also compares the four-county ANF region as an entire region to Pennsylvania.

As the information on land area and population makes clear, the ANF economic region is an area dominated by forests. All four counties have more than 80 percent of their land area in some form of forest management. Public forests that include state and county forests as well as the ANF comprise between 29-52 percent of the land area in each county. Farmland comprises between 2-14 percent of the land area in each county; very low when compared to the average for Pennsylvania of 27 percent. A region so dominated by forests, and a high proportion of public forests, has both limitations and opportunities as compared to other regions.

The ANF economic region comprises nearly 1 percent of the total employment in Pennsylvania. Rural counties often have higher rates of unemployment than urban or broader areas, and the ANF region is no exception. However, with the exception of Forest County, unemployment rates are generally within 0-2 percent of the unemployment rate for Pennsylvania. Despite declines and stagnation in the area's population since 2000, the labor force has continued to grow over the same period in all four counties.

Similarly, rural counties often experience lower income levels than urban or broader averages, and the ANF region is no exception. Unlike the situation for employment, the ANF region has per capita incomes that are 20 percent lower than that for Pennsylvania. In 2000, the ANF region had a higher share of households with incomes lower than \$25,000 and a lower share of households with incomes above \$75,000 than Pennsylvania. However, poverty rates of the ANF region are similar to those of Pennsylvania. This suggests that while the ANF region may have lower incomes than Pennsylvania, it is not a major area of poverty within Pennsylvania. The one factor that partially offsets the diminished income of the ANF region relative to Pennsylvania is that the ANF region has home values that are much lower than the Pennsylvania average, making housing more affordable in the ANF economic region.

Elk County

Although it has not always been the case, in recent years Elk County has experienced the highest income of the four counties. In addition, Elk County has also the lowest poverty rates and compares favorably to the other three counties in all of the income related statistics. Although in the past unemployment has been a greater problem in Elk County, in recent years the county has featured lower rates of unemployment.

The primary reason for this trend is that Elk County is the only county of the four that was able to actually increase the amount of manufacturing employment from 1970 to 2000. Although there has been a decline in manufacturing employment from 2000 to 2004, the county still retains over 35 percent of its employment in the manufacturing sector. This sector also provides over half of the total employee compensation in the county. In particular, Elk County has a large industry in fabricated metal product manufacturing and manufacturing of electrical equipment and appliances. About 1 percent of employee compensation is related to processing of wood products. It also has nondurable goods manufacturing including paper.

Table 3-108. Economic characteristics summary, Elk, Forest, McKean, and Warren Counties and Pennsylvania

Indicator	Elk	Forest	McKean	Warren	ANF Counties Combined	Pennsylvania
Land Characteristics						
Land Area (Sq Miles)	829	428	982	883	3122	44820
Land share in Farmland (%)	4.2%	2.1%	6.6%	13.8%	7.4%	27%
Land share in Forestland (%) /1	90.7%	95.1%	89.2%	81.7%	88.3%	n.e.
Land share in Public Forests (%) /1	52.2%	49.3%	30.1%	29.1%	38.3%	n.e.
Land share in ANF (%) /1	21.1%	41.8%	20%	24.8%	24.6%	1.7%
Population 2004 (Estimate)	34064	4994	44708	42576	126342	12406292
Population Density (Persons/Sq mi)	42	12	47	50	42	274
Employment						
Employment 2003 /2	19,349	2,379	23,049	20,447	65,224	6,969,379
Unemployment Rate 2000	6.0%	8.5%	5.3%	4.1%	5.1%	4.0%
Unemployment Rate 2001	9.0%	15.2%	5.9%	5.1%	7.1%	4.7%
Unemployment Rate 2002	7.9%	15.8%	6.3%	6.8%	7.4%	5.7%
Unemployment Rate 2003	7.2%	16.3%	6.3%	7.1%	7.0%	5.7%
Unemployment Rate 2004	5.8%	10.3%	6.3%	5.9%	6.5%	5.8%
Change in Labor Force 2000-2004	1.7%	15.8%	2.8%	8.1%	4.7%	5.1%
Income						
Per Capita Personal Income 2003/2	\$27,492	\$23,374	\$25,516	\$24,584	\$25,651	\$31,911
Average Annual Wage 2004	\$30,548	\$25,952	\$29,415	\$30,295	\$29,812	\$36,181
Median Household Income 2002	\$38,787	\$28,060	\$33,529	\$35,596	n.a.	\$42,043
% greater than \$75,000 2000	12.8%	6.6%	10.2%	11.8%	n.a.	19.9
% less than \$25,000 2000	32.2%	45.7%	36.8%	32.6%	n.a.	30.5
Poverty Rate 1999	7.0%	16.4%	13.1%	9.9%	10.1%	10.0%
Estimated Poverty Rate 2002	7.6%	12.3%	12.0%	10.3%	10.2%	10.0%
Median Own/Occ. Housing Values 2000	\$78,000	\$57,300	\$53,500	\$64,300	n.a.	97,000
Payments to Local Governments/3						
1995 (25% Fund)	\$1,168,558	\$1,243,358	1,414,350	\$1,535,850	\$5,362,116	n.e.
2000 (25% Fund)	\$649,605	\$691,978	\$786,262	\$853,806	\$2,981,651	n.e.
2005 (Secure Rural Schools)	\$1,401,551	\$1,490,433	\$1,696,789	\$1,838,572	\$6,427,344	n.e.

n.a. not available n.e not estimated All data from Center for Rural Pennsylvania except as noted:

1/ Strauss, Lord and Powell, Economic Impact of the Wood Industry in the AHUG Region, 2004

2/ Bureau of Economic Analysis, Regional Economic Information System, 2006

3/ Payment records of Allegheny National Forest

The other sectors that provide more than 10 percent of the county's employment are Retail Trade, Health Care, and Human Assistance. The other major economic sectors are present but each contributes less than 10 percent of the total share of county employment. Elk County is the only county with less than 10 percent of its employment in the government sector.

Forest County

While the other three counties share some basic similarities in size and composition, Forest County is quite different. Forest County is roughly half the size of the other three counties with a population that is approximately 10 percent of the other three counties. It also has the largest share of its land (95 %) in forestland and the lowest population density (12 per square mile) justly earning its "Forest" name. As the county with the most rural character, it also exhibits the basic difficulties of rural economies. As compared to the other three counties, Forest County has much higher unemployment rates, lower per capita incomes, lower median household incomes, and the largest percentage of households with less than \$25,000 in household income. However, this gap is much smaller with respect to poverty rates and home values.

In several ways, Forest County resembles essentially a residential economy lacking any substantial industries. Only 57 percent of the county's population works in the county; a substantial portion of its population works in adjacent Venango and Warren Counties. Forest County also has substantial summer homes and retired persons among its population. Transfer payments make up almost 40 percent of the personal income of Forest County residents. Earnings from rent, dividends, and interest make up another 20 percent of personal income, leaving Forest County as the county least dependent upon wages and salaries as a source of personal income.

The government sector is the most important economic sector in the county providing nearly 19 percent of all employment and over a third of employee compensation in the county. Other sectors of importance are retail trade, construction, and accommodations and food services.

McKean County

Of the four counties McKean County is the largest county in both area and population, and has the largest economy providing the most jobs and personal income. McKean County has experienced substantial declines in its manufacturing employment since 1970. Still, manufacturing remains the most important economic sector, providing 20 percent of the county's employment and nearly one third of total employee compensation in the county. Prominent within the manufacturing sector are wood product manufacturing, nonmetallic mineral product manufacturing, and fabricated metal manufacturing that collectively account for approximately 16 percent of the total employee compensation in the county. The county also has firms engaged in manufacture of electrical equipment, furniture, and other durable goods. Nondurable goods manufacturing includes food products, textiles, paper, petroleum, and chemical products.

Other sectors of importance in McKean County that provide more than 10 percent of the county's employment are retail trade, Health care, and social assistance, and government. McKean County has firms in forestry, logging, and forestry support activities. Mining and mining support activities primarily for oil and gas extraction are also important sectors in the McKean County economy.

Warren County

Warren County has many of the same features as McKean and Elk counties, but manufacturing employment has declined more rapidly in Warren County than in the other counties. In 2003, manufacturing provided only 15 percent of the county's employment with a decline of approximately 900 jobs from 2001 to 2003. Still, manufacturing provides nearly a quarter of total employee compensation in the county. Wood products, fabricated metal, machinery, petroleum, plastics, and rubber products manufacturing are among the more important industries in this sector.

As compared to the other counties, Warren County has become a prominent area for wholesale and retail trade. This sector provides nearly 20 percent of the employment in the county and approximately one sixth of all employee compensation. The only other sectors providing more than 10 percent of the county's employment are Health Care and Social assistance and government. Warren County has firms in forestry, logging, and forestry support activities. Mining and mining support activities primarily for oil and gas extraction are also important sectors in the Warren County economy. Farming is more prominent in Warren County than in any of the other counties.

Data on unemployment and personal income identifies Warren County somewhere between McKean and Elk counties. Unemployment rates are in a similar range with these counties. Per capita income was lower than these counties in 2003, but average annual wages in 2004 were very close to Elk County. Warren has a slightly greater incidence of poverty, a higher percentage of its households earning less than \$25,000 and the lower home values than Elk County, but better data results for these same measures when compared to McKean County.

Direct and indirect effects

Scope of analysis

The economic contribution of the ANF is broad, but its influence is greatest within the four-county area. Economic impacts of the proposed alternatives will be examined for this four-county area as an average annual impact during the plan period.

Economic and financial efficiency analysis (present net value) and additional technical discussion related to the evaluation of the economic impacts of the alternatives are provided in Appendix B – Economic Analysis Section.

Introduction to effects

The ANF contributes to the local and regional economies primarily through recreation and timber production, revenues to local governments, and direct expenditures of the ANF itself. In a cumulative context, development of subsurface oil and gas resources on the ANF, which are owned almost entirely by private parties, provides a substantial contribution to local economies. Recreation users contribute directly to local economies through purchase of equipment and supplies, and also indirectly through services that support these activities (e.g. hotels, restaurants, etc.). By providing recreational opportunities, the ANF contributes to businesses offering goods and services. This is particularly important to the extent that recreationists from outside the ANF region come here to recreate.

The ANF has the potential to supply a substantial mix of quality timber; approximately one third of ANF land produces valuable black cherry, and other valuable hardwood species on the forest include white and red oak, and sugar and red maple. These species are further processed through national and international markets to create quality furniture and a variety of other finished wood products. In addition, the ANF supplies pulpwood for paper and other wood pulp products, and fuelwood for use as a basic fuel source. By providing the initial supply of wood, the ANF contributes to a variety of businesses in the wood products and related industries.

From the revenues earned by the ANF, a portion of forest revenues have been returned to local governments as part of the payments in lieu of taxes, 25 percent funds, or Secure Rural Schools Act. These revenues are important to local communities in supporting local schools and roads.

The direct business activities of the ANF and the economic activities of its personnel who live and work in the communities neighboring the forest also contribute to a variety of local businesses ranging from electricians to local restaurants.

Finally, a part of the nation's energy needs are met through the production of oil and gas from resources under the ANF. This production is not a direct consequence of Forest Service activities on the ANF, but rather is a cumulative contribution made by the activities of other private parties who own the subsurface mineral rights of the ANF.

The complete estimates associated with these contributions for the current situation and for each of the alternatives are presented in Table 3-109. The estimates that appear in this Table under the current column are used to calculate the ANF's current economic contribution (shown in Table 3-110) and identify the current level in the subsequent tables (Table 3-111 through Table 3-114) that appear under direct and indirect effects. This current level is based upon the following assumptions:

- Recreation visitation is based upon estimates developed from the National Visitor Use Monitoring Data projected for 2005. Only recreation visits deriving from outside the four county area are included.
- Timber volumes and values used to estimate this contribution are an average of the harvest volumes from 2001-2005, adjusted for inflation into 2005 dollars.
- Payments to local governments reflect a 5-year average in 2005 dollars. This average includes payments based on the 25 percent fund and Secure Rural Schools payments.
- Expenditures of the ANF are based upon a 5-year average of the ANF budget from 2001-2005 in 2005 dollars.

To identify the contribution of the ANF to the ANF economic region and the estimated impacts of the alternatives under consideration in this FEIS, the ANF used an input-output analysis model called IMPLAN that identifies the economic linkages among the sectors within the ANF region, and how the region responds to the resources made available by the ANF. For this analysis version 2 of IMPLAN Professional Version 2.0 with 2002 data was used (Minnesota IMPLAN Group 1999). The model considers the initial direct impacts of increased demand for goods and services contributed by the ANF (e.g. increased sale of wood products), indirect impacts of purchases of the directly impacted sectors (e.g. sale of machinery to sawmills), and induced impacts created by the wages and other income generated by the direct and indirect impacts (e.g. employees of local firms taking their families to local restaurants).

Using this model, an estimate can be developed of the contribution made to various sectors of the local economy in both employment and labor income. This serves as the baseline that is also used to compare the results of the alternatives under consideration in the FEIS. Table 3-109 displays the results of this analysis for the four county ANF economic region.

Table 3-109 shows the model's estimate of total employment and labor income within the ANF economic region and the share of these contributed as a result of the activities related to the ANF. In summary, the Table estimates that in the past 5 years the ANF has contributed to about 2.6 percent of the ANF region's jobs and about 2.1 percent of labor income. The sectors with employment most influenced by the ANF are Accommodations and Food Services, Government, Retail Trade, and Agriculture/Forestry. Of these, Accommodations and Food Services and Retail Trade are related to recreation activities. All of the other contributions of the ANF also create induced effects in these sectors. As the ANF is a significant source of government employment and income it directly generates impacts in the federal government sector. In addition, payments to local governments also create direct impacts on the local government sector. Agriculture/Forestry is also stimulated by activities of the ANF that includes logging and contract forestry services. The ANF also contributes to a variety of other sectors.

Table 3-109. Current role of Forest Service-related contributions to the area economy

Industry	Employment (jobs)		Labor Income (Thousands of 2006 dollars)	
	Area Totals	FS-Related	Area Totals	FS-Related
Agriculture, Forestry and Fishing	1,509	126	\$23,335	\$4,241
Mining	1,370	2	\$46,466	\$75
Utilities	290	3	\$22,884	\$264
Construction	2,223	46	\$94,138	\$1,944
Manufacturing	15,046	77	\$791,365	\$3,097
Wholesale Trade	982	33	\$44,606	\$1,517
Transportation and Warehousing	1,711	32	\$68,449	\$1,437
Retail Trade	10,703	200	\$200,220	\$3,795
Information	661	11	\$24,844	\$378
Finance and Insurance	1,589	14	\$60,838	\$517
Real Estate and Rental and Leasing	618	12	\$18,397	\$408
Professional, Scientific, and Technical Services	1,710	56	\$63,050	\$1,476
Management of Companies	112	1	\$11,099	\$90
Administration, Waste Management and Removal Services	835	15	\$18,247	\$339
Educational Services	976	7	\$20,293	\$157
Health Care and Social Assistance	7,574	58	\$238,669	\$1,961
Arts, Entertainment, and Recreation	546	42	\$7,955	\$635
Accommodation and Food Services	3,299	435	\$36,345	\$5,177
Other Services	3,486	46	\$71,704	\$830
Government	6,571	354	\$314,163	\$17,808
Total Forest Contribution	61,811	1,572	\$2,177,065	\$46,143
Percent of Total	100.0%	2.5%	100.0%	2.1%

(Minnesota IMPLAN Group, 2002)

Table 3-110. Forest Service impacts upon ANF region economy

Primary Impacts upon ANF Economy (Average Annual Effect)						
Item	Measure	Current	Alt. A	Alt. B	Alt. Cm	Alt. D
Recreation	M Visits	608	632	634	622	604
Wilderness	M Visits	10	10	10	25	45
Hardwood Sawtimber	MCF	1822	6059	5750	4934	2395
Hardwood Pulp	MCF	1067	4043	3836	3292	1598
Hardwood Fuelwood	MCF	268	796	755	648	314
ANF Expenditures	M \$	16,814	27,054	27,001	24,533	15,386
Payments to Local Governments	M \$	5,619	17,267	16,139	13,353	6,946

M= thousand: thousand visits, thousand cubic feet, thousand dollars

It should be noted that from a labor income perspective the ANF's greatest current contribution (at least one third of its income impact) is in the labor income of government employees. Following in importance is the income for Accommodation and Food Services, Agriculture/Forestry, Retail Trade, and Manufacturing.

Effects from each alternative

Table 3-110 displays the information associated with the plan alternatives that are expected to have some impact on the ANF economic region. All numbers are average annual estimates for the midpoint of the first decade. The table displays current values along with annual estimates of recreation visits and wildlife visits. The estimates of timber output (i.e., hardwood sawtimber, hardwood pulp, and hardwood fuelwood) are based upon full implementation of the alternatives and achievement of the ASQ. The estimate of ANF expenditures and payments to local governments are also based upon full implementation of the plan including harvest at the ASQ level and achievement of other plan objectives. More information on the derivation of these items is contained in Appendix B.

Recreation and wilderness visits are not expected to increase substantially during the plan period. Recreation projections are based on projections for the North contained in Bowker et al, *Projections of Outdoor Recreation Participation to 2050*. Differences in the alternatives are not expected to have a large effect on the amount of recreation visitation. Stable or declining populations in the northern region of the United States along with a demographic shift from younger to older residents are the major reason for this relatively stable view. (See section on Social Conditions)

As all recreation that occurs in wilderness is classified as wilderness recreation, wilderness visits increase and other recreation visits decrease as a function of the amount of recommended Wilderness Study Areas.

Recreation and wilderness visits also include Hunting and Fishing visits. Hunting and Fishing accounts for approximately one third of all of the economic impacts described for the current situation and each alternative.

The other items generating substantial impact all assume full implementation of the alternatives and achievement of the ASQ. All of the four alternatives would provide for higher levels of timber harvest than have occurred as an average over the last 2001-2005 period. Alternatives A and B would triple the harvest over these recent levels and

alternative C would increase the harvest level by more than 2 ½ times. Alternative D's increase is limited to about a 30 percent increase. To deliver volumes at levels displayed, proportionately higher budget allocations will be needed by the ANF for Alternatives A, B, and Cm. However, since only a portion of the ANF's budget is related to timber production, the entire ANF budget does not increase to the same proportion as the harvest level. Finally, the payments to local governments are estimated to increase based upon increased harvest and the 25 percent fund being used as the option for local government receipts, as this would clearly exceed the payment level under a continuation of the Secure Rural Schools Act. A continuation of Secure Rural Schools payments would maintain a level of payments to local governments of 6,383 thousand dollars annually.

It should be noted that all alternatives assume the local economy will respond to the increased opportunities provided by the ANF. In particular, for manufacturing this assumes that the increased timber offered by ANF would be locally processed in the same proportions as the current levels.

Employment

Table 3-111 displays the resulting employment contributions that the alternatives could make to the ANF economic region based upon the particular contributing resource. The table shows contributions from recreation (including wilderness), timber, payments to local governments, and Forest Service expenditures. The table also shows in aggregate employment the change in each alternative from the current level.

Recreation currently provides a substantial contribution to the area's economy including more than half of the employment contributed by the ANF. However, recreation is not expected to appreciably increase in any of the alternatives, contributing between 935-950 jobs in all of the alternatives. With full plan implementation, the increase in timber with its increased effect on ANF expenditures and payments to local governments has the potential to contribute to an increase of roughly 1,000 jobs in Alternatives A and B, more than 750 jobs in Alternative Cm, and more than 150 jobs in Alternative D.

Table 3-112 displays the same information but displays the relative contribution of each alternative to each major employment sector. Most of the increased jobs projected for all of the alternatives would occur in three major sectors: Agriculture, Forestry, and Fishing (including Logging) with approximately 27 percent of the increased jobs, Government with approximately 21 percent of the increased jobs and Manufacturing with about 14 percent of the increased jobs. The remaining 37 percent of the increased jobs could occur in a number of different sectors.

Table 3-111. Employment by program by alternative (average annual, first two decades)

	Total Number of Jobs Contributed				
Resource	Current	A	B	Cm	D
Recreation	898	935	936	943	950
Timber	217	838	784	650	329
Payments to States/Counties	95	291	272	225	117
Forest Service Expenditures	362	581	579	527	330
Total Forest Contribution	1,572	2,645	2,572	2,345	1,726
Percent Change from Current	---	68.3%	63.6%	49.2%	9.8%

(Minnesota IMPLAN Group, 2002)

Table 3-112. Employment by major industry by alternative (average annual, first two decades)

Industry	Total Number of Jobs Contributed				
	Current	A	B	Cm	D
Agriculture, Forestry and Fishing	126	418	393	330	181
Mining	2	4	4	4	3
Utilities	3	7	7	6	4
Construction	46	99	95	83	48
Manufacturing	77	230	217	184	104
Wholesale Trade	33	46	45	43	37
Transportation and Warehousing	32	52	51	47	37
Retail Trade	200	279	274	259	216
Information	11	17	16	15	12
Finance and Insurance	14	29	28	25	16
Real Estate and Rental and Leasing	12	19	19	17	13
Professional, Scientific, and Technical Services	56	97	95	86	56
Management of Companies	1	2	2	2	1
Administration, Waste Management and Removal Services	15	23	23	21	16
Educational Services	7	14	13	12	8
Health Care and Social Assistance	58	112	108	97	64
Arts, Entertainment, and Recreation	42	50	49	49	46
Accommodation and Food Services	435	489	487	477	452
Other Services	46	82	80	72	51
Government	354	578	567	518	363
Total Forest Contribution	1,572	2,645	2,572	2,345	1,726
Percent Change from Current	---	68.3%	63.6%	49.2%	9.8%

(Minnesota IMPLAN Group, 2002)

Income

Table 3-113 displays the contributions to labor income that the alternatives could make to the ANF economic region based upon the particular contributing resources. The situation is similar to the likely impacts associated with employment. Currently, recreation contributes about 18.5 million dollars to labor income within the ANF economic region. However, this is not expected to appreciably rise with any of the alternatives under consideration. Increases in timber harvest, payments to local governments, and ANF expenditures could contribute to increases in labor income of roughly 40 million dollars in Alternatives A and B, 30 million dollars in Alternative Cm, and 5 million dollars in Alternative D.

Table 3-113. Labor income by program by alternative (average annual, first two decades)

	Thousands of 2006 dollars				
Resource	Current	Alternative A	Alternative B	Alternative Cm	Alternative D
Recreation	\$18,411	\$19,165	\$19,207	\$19,387	\$19,620
Timber	\$8,222	\$31,549	\$29,531	\$24,517	\$12,395
Payments to States/Counties	\$3,898	\$11,979	\$11,197	\$9,264	\$4,819
Forest Service Expenditures	\$15,611	\$25,119	\$25,070	\$22,778	\$14,286
Total Forest Contribution	\$46,143	\$87,812	\$85,004	\$75,947	\$51,119
Percent Change from Current	---	90.3%	84.2%	64.6%	10.8%

(Minnesota IMPLAN Group, 2002)

Table 3-114. Labor income by major industry by alternative (average annual, first two decades)

	Thousands of 2006 dollars				
Industry	Current	A	B	Cm	D
Agriculture, Forestry and Fishing	\$4,241	\$16,262	\$15,203	\$12,587	\$6,425
Mining	\$75	\$132	\$128	\$116	\$85
Utilities	\$264	\$540	\$519	\$461	\$306
Construction	\$1,944	\$4,198	\$4,040	\$3,504	\$2,049
Manufacturing	\$3,097	\$9,196	\$8,701	\$7,425	\$4,143
Wholesale Trade	\$1,517	\$2,070	\$2,035	\$1,937	\$1,663
Transportation and Warehousing	\$1,437	\$2,235	\$2,180	\$2,030	\$1,612
Retail Trade	\$3,795	\$5,429	\$5,335	\$5,018	\$4,094
Information	\$378	\$626	\$609	\$557	\$413
Finance and Insurance	\$517	\$1,027	\$991	\$881	\$590
Real Estate and Rental and Leasing	\$408	\$662	\$644	\$596	\$458
Professional, Scientific, and Technical Services	\$1,476	\$2,675	\$2,613	\$2,339	\$1,520
Management of Companies	\$90	\$176	\$170	\$152	\$105
Administration, Waste Management and Removal Services	\$339	\$526	\$514	\$478	\$375
Educational Services	\$157	\$302	\$293	\$261	\$175
Health Care and Social Assistance	\$1,961	\$3,793	\$3,669	\$3,271	\$2,181
Arts, Entertainment, and Recreation	\$635	\$743	\$738	\$728	\$688
Accommodation and Food Services	\$5,177	\$5,778	\$5,757	\$5,644	\$5,352
Other Services	\$830	\$1,559	\$1,508	\$1,354	\$933
Government	\$17,808	\$29,884	\$29,358	\$26,609	\$17,954
Total Forest Contribution	\$46,143	\$87,813	\$85,004	\$75,947	\$51,119
Percent Change from Current	---	90.3%	84.2%	64.6%	10.8%

(Minnesota IMPLAN Group, 2002)

Table 3-114 displays the contributions to labor income that the alternatives could make to the ANF economic region by major economic sectors. With the direct impacts of an expanded ANF budget and increased payments to local governments, the Government sector would have the largest increase of labor income of roughly 12 million dollars in Alternatives A and B, 10 million dollars in Alternative Cm and 5 million in Alternative D. Other sectors with substantial increases in personal income include Agriculture, Forestry, and Fishing (including Logging) with increases of 11 million in Alternatives A and B, 7 million in Alternative Cm, and 2 million in Alternative D. Labor income in Manufacturing could increase by over 5 million dollars in Alternatives A and B, 4 million dollars in Alternative Cm, and just below 1 million dollars in Alternative D. Other sectors that could be increased by over a million dollars in personal income in Alternatives A, B, and Cm include Construction, Retail Trade, and Health Care, and Social Assistance. These same sectors are also increased but to a lesser extent in Alternative D. Most other sectors also could experience increased potential labor income, but primarily as a result of indirect or induced effects of the sectors already identified.

Payments to local governments

Table 3-115 displays the estimated potential payments to local governments that could occur with full implementation of the alternatives in the plan period. Table 3-115 displays the total projected revenues of the ANF under the four alternatives, the estimated payment for all four counties under a continuation of Secure Rural Schools Act payments, the estimated payment total for all four counties and a breakdown of this last estimate for each of the four counties.

With the possible exception of alternative D, the analysis assumes that local governments would opt for payment based upon the 25 percent fund rather than Secure Rural Schools, since in all four alternatives, full implementation would produce payments greater than the Secure Rural Schools Act level. The clear assumption is that full implementation would actually occur with harvests at the projected prices; if full implementation does not occur and harvest levels are equal or less than the 2001-2005 period, retaining payments based on Secure Rural Schools Act would be preferable.

Table 3-115. Forest Service revenues/payments to sounties (average annual, first two decades)

	Thousands of 2005 dollars				
	Current	A	B	Cm	D
All Program Revenues	\$18,164	\$69,066	\$64,554	\$53,411	\$27,792
Estimated Secure Rural Schools	\$6,384	\$6,384	\$6,384	\$6,384	\$6,384
Estimated Payment to Counties	\$5,619	\$17,267	\$16,139	\$13,353	\$6,946
Elk County	\$1,224	\$3,762	\$3,517	\$2,910	\$1,514
Forest County	\$1,304	\$4,008	\$3,746	\$3,099	\$1,612
McKean County	\$1,481	\$4,551	\$4,254	\$3,519	\$1,831
Warren County	\$1,609	\$4,945	\$4,622	\$3,824	\$1,989

In comparing the alternatives, clearly Alternatives A and B would provide the highest level of increase (roughly 11 million dollars, C would provide an increase of nearly 8 million dollars and D would provide a small increase. The breakdown by county is based on the distribution proportions previously in effect for the 25 percent funds. Of these payments, school districts would receive about 52 percent of the total payments and townships would receive 48 percent for roads. Counties would no longer receive a distribution as they do under Secure Rural Schools.

Cumulative effects

The cumulative effects boundary is the four-county area or ANF region. Past trends will be described for 2001 to 2005 and future projections described for the first decade of the plan. The following three major economic effects upon the ANF region will be addressed: oil and gas production on the ANF and in the ANF region, the potential for sharply increased recreational visitation, and the continued challenge of a decline in manufacturing in the ANF region.

Oil and gas

Oil and Gas extraction from the ANF subsurface provides a very substantial economic contribution. Since the oil and gas production from the ANF is on privately held subsurface lands, the ANF does not collect production data. A very rough estimate of the production levels attributable to the ANF subsurface suggests that an annual production of 6.5 million barrels of oil and almost 20 billion cubic feet of natural gas are currently being produced from this mineral estate. Drilling for new oil wells, which has averaged 327 wells per year from 2001 to 2005, also provides substantial contribution to the local economy. At this current level, oil and gas development of the ANF subsurface is estimated to provide 1,321 jobs in the ANF region focusing primarily on nearly a thousand jobs in the Mining sector directly involved with the extraction of these petroleum resources. At this current level, Labor Income associated with oil and gas development of the ANF subsurface is estimated to contribute a total of 42 million dollars of which nearly 32 million is in the Mining sector. The other economic sectors in the ANF region are affected primarily through indirect and induced effects from this mining activity.

With the recent increases in oil and gas prices, ANF projections suggest that increased oil and gas development is likely over the plan period. Using the projections of oil and gas well development outlined in Chapter II and described in Appendix F, production approximately eight years from now suggests increased production to 8.7 million barrels of oil and 28 billion cubic feet of gas each year along with the construction of 512 new wells each year on the ANF. This level of development is estimated to increase employment by about 500 jobs and labor income by 16 million dollars above the current level. Again the bulk of this increase would occur in the Mining sector with indirect and induced economic impacts on other sectors.

However, there is concern that these cumulative effects of oil and gas development may limit or reduce the economic impacts that are associated with other parts of the ANF plan. Managing a land base for forest products is substantially more complicated if oil and gas development is actively occurring at the same time. Key forestry activities that are important to forestry on the ANF such as prescribed fire, fencing, and use of herbicides are more difficult to accomplish in areas that are also managed for oil and gas extraction.

Similarly, there is concern that the attractiveness of the forest for recreation visitors and the experiences that they seek could be affected by substantial oil and gas activity. If this occurs and visitors choose to avoid the ANF rather than come in the same numbers as the recent past, a variety of businesses could suffer from this diminished visitation. All of the alternatives have objectives for acquisition of subsurface rights in the areas considered to be most desirable for their natural character. If these subsurface rights can be acquired, it may prevent or mitigate oil and gas development in these areas.

Recreation

Another potential cumulative impact is the Pennsylvania Wilds program. This program seeks to market the “Wilds” region and its natural and recreational opportunities. Part of this effort will include creating a greater number of tourist destinations within the ANF region and featuring the ANF as a destination. The ANF has a goal of cooperating with this effort to boost tourism and visitation in the five county area. If this effort is successful, there could be substantially more visitation to the ANF than has been estimated. Along with this would be greater economic impacts on the sectors most affected by recreational visitors.

To explore potential consequences of an increase in visitation to the ANF well above the projected trends for the North region (Bowker *et al.* 1999), an analysis was conducted on all of the alternatives to examine what potential economic impacts could occur with a full 20 percent increase in outside visitors to the ANF by 2010 over the NVUM estimates for 2002. Such a change would boost employment and labor income for all of the alternatives. Recreation activity could contribute in excess of 1,000 jobs for each alternative or an increase of roughly 130 jobs from those shown in Table 3-111. Half of the increase would be projected to occur in Accommodation and Food Services and Retail Trade sectors. Labor Income would also increase adding 2.5 million dollars. However, the proportional increase in labor income would be less than the proportional increase in jobs, since the sectors most affected by an increase in visitation provide earnings lower than the average for each job.

Decline in manufacturing

Finally, the net loss of manufacturing jobs throughout the ANF region is continuing as the region struggles to match the challenge of global competition. This section has highlighted the economic importance of this sector to the ANF region. Policies for more effective retention of manufacturing jobs within the ANF region is beyond the scope of the ANF forest plan. While the previously described potentials of the ANF under the described alternatives may be able to make a positive contribution to the ANF economic region, it will not fundamentally offset continued substantial decline in the manufacturing sector.

3.4.8 Social Conditions

This section has been updated to reflect modifications to the DEIS Alternative C.

Introduction

The Allegheny Plateau has seen interaction between various peoples and the natural environment for perhaps 11,000 years. Population levels have varied over time with the nature and intensity of resource use and the degree

of success sustaining use of the resource base. What happens between people and their environment on the Allegheny Plateau is strongly affected by the environment and society beyond the Plateau. These larger environmental influences on the Allegheny Plateau have ranged widely. For example, the Plateau was not glaciated, and as a result the soils are highly weathered and lacking in key nutrients. Today winds carry acid rain onto the land from the Ohio Valley. The Plateau's ample system of rivers and streams provided ready access and allowed early human penetration, along with the spread of plant and animal species from other areas. Human influences have also been varied: numerous in- and out-migrations of people, the application of new technologies (e.g. fire to promote growth of certain tree species and advanced recovery methods for oil and gas), implementation of local, state and national government policies, and global economic demand for oil, wood and outdoor recreation opportunities. The Allegheny Plateau and the Allegheny National Forest remain dynamic landscapes because of the interaction of people and the natural environment. The Allegheny also presents a unique management challenge for social, economic and environmental sustainability of a working forest and its nearby communities.

A brief socio-ecological history

Paleo-Indian occupation of what is today the Allegheny National Forest occurred during the late stages of the Wisconsin glaciation, probably about 9,000 B.C. The environment of this period was strongly influenced by the proximity of a retreating ice mass north of the St. Lawrence Valley. The valleys of Brokenstraw Creek and the upper Allegheny River provided a readily available route of transportation.

Following the Paleo-Indian period, peoples of the Archaic period (ca. 8,000 B.C. – 1,000 B.C.) developed a culture based on hunting, fishing, and gathering of wild vegetable foods. The Late Archaic period in northwestern Pennsylvania is associated with the maximum spread of the Oak-Hickory forest association across much of the Allegheny Plateau, which allowed an increase in the human population along the Allegheny River and its major tributaries. The term Allegheny is probably a corruption of Alligewi-hanna, "stream of the Alligewi," an earlier cultural group.

During the Woodland period (ca. 500 B.C. - A.D. 1650), horticulture became increasingly prominent among the cultural groups in the Eastern Woodlands. The Iroquois cleared and burned the forests to create open spaces, allowing cultivation of sunflowers, maize (corn), squash, and beans in cleared fields extending out from a central village. After a decade or so villages were moved because of depletion of soil and wood. The landscape in the Allegheny River valley during the Late Woodland period resembled a mosaic of crop lands near settlements, abandoned open spaces with early structural growth, and open forest stands dominated by fire-adapted species, such as oak and hickory.

Throughout prehistory the Allegheny River watershed served as a water travel route. The Allegheny watershed is within the Ohio and Mississippi drainages, which reach to the Rocky Mountains, nearly to the Great Lakes, east into Appalachia, and to the Gulf of Mexico. With known portages connecting the Allegheny River with the lower Great Lakes and the Susquehanna River, the area became an important travelway during the French Fur Trade of the 1600s and 1700s.

The Early Logging period (ca. 1800 - 1860) saw the slow influx of American settlers, attracted by the stands of white pine along the major stream valleys. The area was at the head of the Ohio Valley, which was opening up to

American settlers, making it economically feasible to transport lumber to markets on the Allegheny, Ohio, and Mississippi rivers. Water-powered sawmills were strung along streams, with larger mills spawning small communities. Swedes and Swedish-Americans, among the most skilled woodsmen in the world, were among the first ethnic groups. After the American Revolution and resolution of Indian claims, early settlers focused on harvesting white pine.

The Oil Boom period, 1859-1930, brought significant population increase to the region, New Englanders, Germans, and other European immigrants to work in oil exploration, transportation, refining, and speculation. The discovery of oil had the greatest economic and environmental impact on the Allegheny Plateau. The demand for oil brought urbanization and industrialization to the region. Railroads were built in response to oil and then timber industry needs. Agriculture changed from subsistence to commercial farming. And for the first time, urbanization and industrialization brought structured leisure time, allowing many to hunt, fish, hike, and recreate in the region.

Three industries dependent upon forest products flourished at the beginning of the 20th Century: wood products, tanning industry, and wood chemicals. Rapid industrialization created high demand for related forest products, with innovations in technology to increase the efficiency of exploitation. Railroad technology designed especially for logging ushered in the Railroad Logging Era, 1880-1940. Between 1890 and 1920, the forests in the region were almost completely clearcut. This profoundly influenced economic development and settlement patterns, as well as the ecological communities found on the Allegheny National Forest today.

At this time, a national movement to restore and conserve over-exploited lands in the United States had as one of its centers the eastern forests, and two Pennsylvanians were key proponents, Gifford Pinchot and Joseph Trimbel Rothrock. On the Allegheny National Forest, the conservation period began with creation of the ANF and continues to the present. This is the public response to the timber and wildlife depletion and soil damage from heedless timber and oil and gas ventures. The Allegheny began in 1923 to purchase tracts of denuded land from willing sellers.

Following the collapse of the stock market in 1929 and failure of banks into the 1930s, the Franklin D. Roosevelt administration mobilized millions of unemployed workers on conservation work throughout the country. The New Deal programs of the 1930s, especially the Works Progress Administration (WPA), brought new jobs into the Allegheny Plateau region and were the driving force behind the construction of many roads, bridges, courthouses, and schools. The Civilian Conservation Corps (CCC) provided jobs to people, including reforestation of part of the Allegheny National Forest.

On a national, regional, and local scale, the wood products industry is no longer the prominent force it was earlier. However, on the Allegheny Plateau, the practice of sound forest management has shown solid results on the Allegheny National Forest, on Commonwealth of Pennsylvania lands, and land owned privately by corporations and individuals. The wood products industry has recovered to become an important part of the regional economy.

The petroleum industry on the Allegheny Plateau also has changed dramatically during the Conservation period. In its heyday, over 90 percent of the world's oil supply came from the region, but is now down to a fraction of one percent. Many of those who migrated to the region to work stayed, settled in larger towns, and took jobs outside the industry. New technologies in the oil fields and in the increasingly important gas fields helped to maintain a core of the industry capable of responding to periodic price increases with production increases. With 93 percent

of the subsurface mineral rights privately owned, this clearly affects successful management of the Allegheny National Forest today.

During the Conservation period the U.S. Army Corps of Engineers built large dams for flood control, electrical power, and outdoor recreation. The damming of rivers produced a movement to conserve rivers in a more natural state. A stretch of nearly 87 miles of the Allegheny River was added to the National Wild and Scenic River system in 1992, and in 1996, 62 miles of the Clarion River was also designated. Increasing interest in outdoor recreation in the Allegheny National Forest region, particularly among Baby Boomers approaching retirement, is a natural outgrowth of the Conservation period. (For an alternative modern historical delineation, see Whitney (1990).

Affected environment

The ANF's primary area of influence is the northern Pennsylvania counties of Elk, Forest, McKean, and Warren. Some local influence also extends into various adjacent counties of Pennsylvania and New York State. These influences are due primarily to commerce (particularly timber, minerals, and construction), recreation, and relationships with the Seneca Nation of Indians, Allegany State Park in New York, and Cooks Forest State Park in Pennsylvania. Non-local influence extends to Pittsburgh, to the Youngstown-Cleveland area of Ohio, and to Buffalo, NY. Social environment information is summarized from the *Social Assessment for the Allegheny National Forest*, developed by Penn State University for the forest plan revision process. This document is available in the planning record.

For the social assessment, and the summary below, the population was analyzed on five levels:

1. Commonwealth of Pennsylvania;
2. ANF Core Counties (four Pennsylvania counties that contain the ANF – Elk, Forest, McKean and Warren Counties);
3. Nearby Rural Counties (nine rural Pennsylvania counties - Cameron, Clarion, Crawford, Jefferson, Venango Counties plus the ANF Core Counties, and Cattaraugus County New York) within a 60-mile radius of the ANF;
4. Nearby Urban Counties (Erie County, Pennsylvania, and Chautauqua County, New York) within a 60-mile [approximate] radius of the ANF; and
5. Extended Influence Counties (a large group of counties in western Pennsylvania, western New York, northeastern Ohio, and northern West Virginia that are within a 60-mile to 150-mile approximate radius of the ANF. The population of this area is largely urban-suburban residents and includes Pittsburgh, Cleveland, Akron, and Buffalo metropolitan areas).

This breakout of counties provides comparisons of rural-urban differences, rural counties most directly affected versus those rural counties less directly affected, and nearby urban counties versus larger, more distant urban counties. The 150-mile radius arc represents the counties identified in earlier market research (Van Landingham *et al.* 1988) as having approximately 85 percent of the users of the Allegheny National Forest. They also represent the counties with the greatest social and economic interaction with the Forest, with the interaction generally becoming less marked and less direct with increased distance from the four ANF Core Counties.

This analysis also uses data from the Center for Rural Pennsylvania, for which a separate breakout of counties is used. These breakouts are: the Commonwealth of Pennsylvania; all rural counties in Pennsylvania; the twelve counties of the newly designated PA Wilds program (Cameron, Clarion, Clearfield, Clinton, Elk, Forest, Jefferson, Lycoming, McKean, Potter, Tioga, and Warren); and the ANF Core Counties (Elk, Forest, McKean, and Warren). This allows for comparisons within the Commonwealth, capturing commonalities of policies and administrative structure. It also allows for comparison of counties in the northern tier of the Commonwealth (PA Wilds program) with similar resource endowments, transportation infrastructure, and population densities.

Population trends

Population

Between 1960 and 2000, Pennsylvania as a whole and the two Nearby Urban Counties of Erie, PA and Chautauqua, NY experienced modest population growth (8.5% and 5.9%, respectively). In contrast, ANF Core Counties experienced modest population decline (8.5%). Nearby Rural Counties and Extended Influence Counties both experienced modest population growth between 1960 and 1980, followed by population decline between 1980 and 2000, with net changes for the entire period of less than 4.0 percent.

The Center for Rural Pennsylvania released estimated population data for rural counties in the Commonwealth in December 2005. Table 3-116 shows changes in population for Pennsylvania, all Rural Counties, the twelve PA Wilds counties, and the ANF Core counties. Rural counties as a whole have shown steady population increase since 1950. The northern tier counties in the PA Wilds program may have hit a population peak at the end of the 20th Century, whereas the ANF Core counties population decline has been fairly consistent since 1950. Longer-term projections through 2020 from the Pennsylvania State Data Center anticipate an acceleration of population loss for the 2000 to 2020 period compared with the rate during the 1990 to 2000 decade (Table 3-117). The PA Wilds program counties also show continuation of their decline begun after 2000.

A longer-term view of the four ANF Core Counties shows a considerable variation within this pattern (

Table 3-118). From 1900 to 2000, there was a slow decrease in population of the ANF Core counties, there was slightly declining population overall during the first two decades (1900 – 1920), then a modest increase from 1920 until 1970 with the exception of the World War II decade (1940 – 1950), and then a steady and increasing population decline from 1970 to 2000. But, only during two decades did all four counties populations move in the same direction: all gained population from 1930 to 1940 and all lost population from 1980 to 1990.

Table 3-116. Change in population, 1960-2000

	1960	1980	2000
Pennsylvania	11,319,000	11,865,000	12,281,000
ANF Core Counties	142,000	141,000	130,000
Nearby Rural Counties	457,000	479,000	455,000
Nearby Urban Counties	396,000	427,000	421,000
Extended Influence Counties	9,209,000	9,261,000	8,857,000

Table 3-117. Population 1950 - 2020 by geographic region within Pennsylvania

	Pennsylvania (State Total)	PA Rural Counties	Counties in PA Wilds Program	Counties in ANF
Population, 1950	10,498,012	3,032,143	509,288	138,752
Population, 1990	11,881,643	3,253,143	517,388	131,861
Population, 2000	12,281,054	3,393,946	524,321	129,857
Population, 2004 (Est.)	12,406,292	3,431,516	517,809	126,342
% Change in Population, 1990-2000	3.4%	4.3%	1.3%	-1.5%
% Change in Population, 2000-04	1.0%	1.1%	-1.2%	-2.7%
Projected Population, 2020	12,569,017	3,500,841	500,627	120,763
Projected % Change, 2000-2020	2.3%	3.1%	- 4.5%	- 7.0%

Table 3-118. Population 1990 - 2000 by national, state and ANF counties

	United States	Pennsylvania (State Total)	Elk County	Forest County	McKean County	Warren County	Four - County Total
2000	281,421,906	12,281,054	35,112	4,946	45,936	43,863	129,857
1990	248,709,873	11,881,643	34,878	4,802	47,131	45,050	131,861
1980	226,545,805	11,863,895	38,338	5,072	50,635	47,449	141,494
1970	203,211,926	11,793,909	37,770	4,926	51,915	47,682	142,293
1960	179,323,175	11,319,366	37,328	4,485	54,517	45,582	141,912
1950	151,325,798	10,498,012	34,503	4,944	56,607	42,698	138,752
1940	132,164,569	9,900,180	34,443	5,791	56,673	42,789	139,696
1930	123,202,624	9,631,350	33,431	5,180	55,167	41,453	135,231
1920	106,021,537	8,720,017	34,981	7,477	48,934	40,024	131,416
1910	92,228,496	7,665,111	35,871	9,435	47,868	39,573	132,747
1900	76,212,168	6,302,115	32,903	11,039	51,343	38,946	134,231

Taken together these three sets of population data suggest several things about the ANF Core counties. The long-term relative stability in population suggests that these counties are well beyond the influence of large urban areas, which have shown significant population increases in their neighboring rural counties over the past half century or longer. The movement up and down in population appears to be characteristic of areas greatly influenced by cyclical natural resource industries, in this case timber and oil and gas. The pattern of all counties gaining population during the Depression decade of the 1930s is characteristic of rural areas in many industrialized countries during severe economic dislocations. And, this pattern was probably accentuated here because of the many rural public works programs of the Roosevelt administration.

The generalized loss of population in the ANF Counties during the 1980s paralleled a national trend of those rural counties not influenced by urban growth and suburbanization into adjacent rural counties. The counties with greater economic diversity (Elk, McKean and Warren) have less fluctuation than Forest County, which had been much more dependent on cyclical natural resources, particularly timber. This may change now that construction by the Commonwealth of a prison in Marienville has added the stability and diversity of public sector employment to the county.

Age

Each of the five social assessment geographic areas experienced a steady decline in the percentage of children (age 17 or less) and steady increases in the percentage of adults (ages 18-64) and seniors (ages 65 and older). In 2000, ANF Core Counties were broken down as follows: 23.9 percent children, 59.1 percent adults, 17.0 percent seniors.

Comparisons for the later 2000-to-2003 period (Table 3-119) across rural, PA Wilds program, and ANF counties show similar drops among those under 18 years old, but with more pronounced declines in the PA Wilds and ANF counties groupings. Seniors (over 65) continue to grow as a proportion of the population in the northern tier counties of Pennsylvania, particularly in the four ANF counties. Significantly, across these groupings only the ANF counties show a drop in the 18-to-64 age group. This cohort is usually associated with child rearing, peak productivity at work, high levels of contribution to the economy and community involvement.

Table 3-120 shows projections to 2020 across these same county breakouts as above for those under 20 years of age and those over 65. Taken together, these two age cohorts are often considered as “dependent,” although those over 65 are much more independent than in previous generations. The projections for the ANF counties show a faster rate of decline of youth population numbers and faster rate of increase for seniors than do the Commonwealth as a whole, the rural counties grouping, and even the other PA Wilds counties.

This combination demonstrates a need to attract and retain more people in the large middle group from 18 or 20 to 64 years of age. When this “graying” trend is coupled with the projected decline in population discussed above, these structural changes in population may have effects on overall community vitality, delivery of essential services, and community character. Community leaders in the ANF Counties, like those at the state and regional levels, are very much aware of these trends and are either considering or have already begun to implement strategies to deal with this complex challenge. Among the areas most frequently discussed by leaders when considering strategies to attract and retain young adults and families is education (see below).

Table 3-119. Age cohorts by Pennsylvania geographic region

	Pennsylvania (State Total)	Rural Counties	Counties in PA Wilds Program	Counties in ANF
# Persons Under 18 Years Old, 2003 (est.)	2,830,694	744,641	113,371	28,532
% Population Under 18 Years Old, 2003	22.9%	21.8%	21.9%	22.4%
% Change in Persons Under 18 Years Old, 2000-03	-3.1%	-4.7%	-7.0%	-8.1%
# Persons 18 to 64 Years Old, 2003 (est.)	7,633,001	2,119,228	318,062	76,619
% Population 18 to 64 Years Old, 2003	61.7%	62.0%	61.3%	60.2%
% Change in Persons Between 18-64 Years Old, 2000-03	2.6%	3.1%	0.9%	-0.2%
# Persons 65 Years Old and Older, 2003 (est.)	1,901,764	556,774	87,297	22,204
% Population 65 Years Old and Older, 2003	15.4%	16.3%	16.8%	17.4%
% Change in Persons 65 Years Old and Older, 2000-03	-0.9%	0.0%	0.2%	0.8%

Table 3-120. Projected youth and senior populations by Pennsylvania region

	Pennsylvania (State Total)	Rural Counties	Counties in PA Wilds Program	Counties in ANF
% Population Under 20 Years Old, 2000	26.6	26.1	26.4	26.2
% Projected Population Under 20 Years Old, 2020	24.7	24.1	23.7	22.3
% Population 20 to 64 Years Old, 2000	57.8	57.5	57.0	56.8
% Projected Population 20 to 64 Years Old, 2020	56.9	56.6	55.7	56.0
% Population 65 Years Old and Older, 2000	15.6	16.4	16.6	17.0
% Projected Population 65 Years Old and Older, 2020	18.4	19.3	20.6	21.7

Marital status

In all five social assessment geographic areas, married people became less common and divorced people became more common between 1960 and 2000, mirroring national trends and suggesting an increase in the number of non-traditional households. The smallest decrease in the percentage of married people during this period occurred in the ANF Core Counties (14.5% decrease, from 67.7% in 1960 to 57.9% in 2000). At the same time, the largest increase in divorced people occurred in the ANF Core Counties (517.6% increase, from 1.7% in 1960 to 9.5% in 2000).

Ethnicity

Although Caucasians/whites remain the predominant ethnic group in all five social assessment geographic areas, each area experienced an increase in the percentage of African Americans and other ethnic minority groups. Although ethnic diversity increased in the ANF Core Counties and Nearby Rural Counties, both areas remained less diverse than the other three, more urban areas. The ANF Core Counties shifted from 99.8 percent Caucasian in 1960 to 97.9 percent Caucasian in 2000, the smallest decrease of the areas considered.

Gender

In all five social assessment geographic areas, the ratio of males to females was consistent with larger population patterns, with females slightly more numerous than males. In 2000, the highest percentage of females (51.9%) was found in Extended Influence Counties, and the lowest percentage of females (50.3%) was found in ANF Core Counties.

Education

Education and income, and to some degree occupation, relate to stakeholders' perceptions and uses of the ANF by influencing the amount of money that can be spent on recreation, the amount of time one has to enjoy the forest, and the nature of one's relationship to the forest. As a result, these factors play a large role in helping identify stakeholders' ANF-related beliefs, expectations, and behavior. Income and employment are addressed in the economics section.

All five social assessment geographic areas showed a marked increase in educational attainment between 1960 and 2000, and all five geographic areas showed an increase in attainment across all educational levels. In other words, the percentage of people who completed high school, the percentage of people who completed some post-high school study, and the percentage of people who completed four or more years of college all increased. In 2000, post-high school study remained somewhat less common in ANF Core Counties and Nearby Rural Counties than in the other three areas. In those two areas, fewer than 35 percent attended school beyond high school, compared to more than 40 percent in the other geographic areas.

From a comparative perspective within Pennsylvania (Table 3-121), the ANF counties' educational attainment profile has less spread across the educational spectrum than PA rural counties, i.e., fewer people over 25 with no high school diploma (lower edge of the profile), but also fewer people over 25 with a bachelor degree or higher (upper edge of the profile). This reflects the lower high school drop out rate in the ANF counties (not show). It may also reflect the lower demand for and opportunities for those with bachelor degree or higher education in the ANF counties. During the 1990s, the rate of growth in those over 25 with a bachelor or higher degree education was about 10 percent behind the PA Wilds counties as a whole and over 25 percent behind Pennsylvania rural counties generally.

Table 3-121. Highest level of education by Pennsylvania geographic region

	Pennsylvania (State Total)	Rural Counties	Counties in PA Wilds Program	Counties in ANF
Persons Age 25 Years and Older, 2000	8,266,284	2,293,262	354,667	89,941
% With No High School Diploma	18.1%	19.2%	18.9%	16.9%
% With High School Diploma or Equivalent	38.1%	45.9%	47.5%	48.8%
% With Some College or Associate Degree	21.4%	19.5%	20.1%	20.9%
% With Bachelor Degree or Higher	22.4%	15.4%	13.4%	13.4%
# Adults (25+) With Bachelor Degree or Higher, 2000	1,847,631	352,435	47,548	12,073
Change in Adults With Bachelor or Higher Degree, 1990-2000	30.8%	36.7%	30.1%	27.3%

Table 3-122. School expenditure statistics by Pennsylvania geographic region

	Pennsylvania (State Total)	Rural Counties	Counties in PA Wilds Program	Counties in ANF
Total Expenditures (\$1,000), 2003-04	\$19,394,989	\$5,086,498	\$826,890	\$178,171
Expenditures Per Student, 2003-04	\$10,697	\$9,956	\$10,290	\$9,532
Change in Real Expenditure Per Student, 1999-2000 to 2003-2004	19.6%	19.1%	24.7%	14.6%
Average Salary for Full-Time Classroom Teacher, 2003-2004	\$52,640	\$48,108	\$47,236	\$45,967
Change in Real Teacher Salary, 1999-2000 to 2003-2004	3.8%	2.2%	-0.6%	-1.7%

Educational expenditures are not necessarily a measure of effectiveness of educational systems. Still, it is worth noting that expenditures in the ANF counties per student are growing less quickly in the last 5 years than in the state as a whole and than in rural counties as a group (Table 3-122). The rate of growth of per student expenditures lags the PA Wilds counties by more than half. This parallels the absolute decline in teachers' salaries over the same period. The rate of decline of teachers' salaries is about triple that of the PA Wilds counties. It is very possible some of this decline reflects retirement of older, more highly paid teachers, including early retirement of the faculty as teacher numbers are reduced to match reductions in student numbers.

Among the four ANF Counties there are several locations to pursue coursework toward higher education. However, there is only one bachelor degree granting campus, the University of Pittsburgh-Bradford, and no institutions offering associate degrees or advanced technical training with degree credentials where the student can finish all his or her coursework. As mentioned above, community leaders, as well as elected officials at the local, state and even national level, recognize this as a need for the region, and various efforts to meet it are in process.

Lifestyles and social organization

Population movement and occupancy

Population changes can greatly influence perceptions and expectations of the ANF and its four core counties. For example, new people moving into the region may hold values and beliefs that differ from long-time residents, leading to diverse opinions about the role of the forest within the community. Household composition, family composition, and family size are also factors that influence uses of the ANF and expectations about the Forest's relationship with neighboring communities.

Residential stability and migration

In all five of the social assessment geographic areas, individuals living in the same house as the previous year were more common than individuals who had moved to a different house. Between 1960 and 2000, the proportion of the population of the ANF core counties living in the same house as the previous year had increased from 65.1 percent to 68.3 percent, and was highest among the five geographic areas. Among those who moved to a different house within the ANF core counties, the proportion of those who moved within the same county decreased from 24.0 percent to 20.9 percent, while the proportion who moved to a different county or different state did not show a consistent trend.

Using the Center for Rural Pennsylvania data to compare the ANF counties with other groupings for 1995 to 2000 (Table 3-123), the ANF counties showed a less mobile (or more stable) population than the Commonwealth as a whole, all rural counties and the PA Wilds counties. This remains true if those who moved within the same county are included. Similarly, there is less in-migration to the ANF counties from elsewhere in Pennsylvania, and the entire PA Wilds counties, including the ANF counties, showed limited in-migration from outside the Commonwealth.

Table 3-123. Migration by Pennsylvania geographic region

	Pennsylvania (State Total)	Rural Counties	Counties in PA Wilds Program	Counties in ANF
# Persons 5 Years Old and Older, 2000	11,555,538	3,205,486	495,498	122,615
% Who Did Not Move Between 1995 and 2000	63.5%	65.5%	65.7%	68.3%
% Who Moved Within Same County	21.7%	19.4%	21.0%	20.9%
% Who Moved From Another Pennsylvania County	7.6%	8.7%	8.6%	5.7%
% Who Moved From Another State or Abroad	7.2%	6.4%	4.7%	5.1%

Migration is generally regarded as being associated with change, which can be positive or negative or ambiguous. Migration is usually motivated by both “pull” factors in the receiving area and “push” factors in the sending area. When the migration data here is viewed in light of the other demographic data above, e.g. for age cohorts, it may be inferred that those staying or migrating to the ANF counties (and the rest of the PA Wilds counties) are largely content with the pace and direction of change and/or have strong economic opportunities and family ties to the region. The opposite may be said of those leaving the region, i.e., they are unhappy with either the rate or direction of change and/or do not have sufficiently strong family or economic ties to discourage their out-migration. The age data strongly supports this, as does much of the anecdotal, qualitative data from public meetings, media coverage, and citizen commentary in local newspapers.

Family composition and size

Family composition

All five social assessment geographical regions experienced an increase in the proportion of householders living alone, as well as an increase in the proportion of householders and non-relatives living together. The proportion of householders with spouse, children, and/or other relatives living together declined. Married couples (with or without children under the age of 18) were the dominant family type in all five geographic areas, but there was an increase in the percentage of individuals living alone. The largest increase in individuals living alone occurred in the ANF Counties (39.2%).

Table 3-124. Households/families by Pennsylvania geographic region

	Pennsylvania (State Total)	Rural Counties	Counties in PA Wilds Program	Counties in ANF
# Households, 2000	4,777,003	1,316,901	206,227	51,844
% Change in Households, 1990-2000	6.3%	8.1%	5.8%	3.4%
# Families, 2000	3,208,388	910,031	141,269	35,296
% Change in Families, 1990-2000	1.7%	3.0%	0.3%	-2.3%

Family size

Family size decreased slightly, and averaged about 3.0 people per family for all five social assessment geographic areas. Data from the Center for Rural Pennsylvania bring these trends into better focus with comparisons across Pennsylvania for 1990 to 2000, Table 3-124. While there is a modest increase in the number of households across the state, the rate of increase in ANF counties is about two-fifths the rate of increase of PA rural counties generally and about three-fifths that of the PA Wilds counties. And while the number of families in the PA Wilds counties as a whole was flat from 1990 to 2000, the ANF counties actually lost more than 2 percent of their families. This information, when coupled with the loss between 2000 and 2003 of the 18 to 64 year old age cohort, presents a challenge to the four ANF counties. Families of this age cohort generally are the most productive and dynamic, contribute the most to the local economy in terms of consumption and taxes, and provide for future generations with knowledge of the area and an attachment to its sense of place, and who regard the area as their home.

Attitudes, beliefs, and values toward land use patterns

According to *Stakeholder's Forest Value Orientations and Management Preferences for the Allegheny National Forest* (Zinn *et al.* 2003), stakeholders rated environmental and amenity management requirements as *extremely to very important* on the ANF. In contrast, resource utilization management requirements were rated as *somewhat important*. It is important to note that respondents to the survey were primarily men (67.9%), Caucasian (93.6%), and averaged 54.0 years old.

The report groups respondents by county of residence into three areas: those living in Erie County PA and Chautauqua County NY (inner urban strata); those living in Cameron, Clarion, Crawford, Elk, Forest, Jefferson, McKean, Venango, and Warren County PA, and Cattaraugus County NY (inner rural strata); and, those living in a broader geographic area that included 22 Pennsylvania counties, 3 New York counties, 16 Ohio counties, and 3 West Virginia counties (outer strata). Previous market analysis showed that these counties together were the source of 85 percent of the users of the Allegheny National Forest.

Respondents from the inner rural counties were most likely to report currently living in a rural area or small town (82.9%) and most likely to report growing up in a rural or small town (77.7%). In contrast, fewer than half of respondents from the inner urban counties and outer counties reported living in a rural area or small town (45.6% and 42.0%, respectively), and slightly less than half of these respondents reported growing up in a rural area or small town (48.7% inner urban and 49.6% outer).

Summarizing this report, fewer than five percent of respondents reported feeling extremely well informed about activities on the ANF, and fewer than ten percent reported feeling well informed. Across all counties, respondents rated beauty and recreation, water quality, wild areas, and fish and wildlife habitat as *very to extremely important*, and wood products, oil, gas, and minerals as *somewhat important*.

Personal importance of the ANF varied significantly across geographic space. Thirty-two percent of the inner rural, 23 percent of the inner urban, and 17 percent of the outer counties rated the ANF as *extremely important to me*. However, more than 80 percent in each grouping rated the ANF as *extremely important* or *somewhat important to me*. Eighty percent of the respondents rated manager's performance *managing the ANF in a long-lasting, sustainable way* as *good* or *excellent*. Differences across groupings were not significant.

Another way to consider the value people place on the ANF is recreation use surveys conducted on parks, forests, and other federal lands as part of National Visitor Use Monitoring (NVUM), discussed in more detail in the recreation section. The NVUM survey results indicate that 80 percent of the visitors to the ANF live within a 100-mile radius of the forest, and most reside in the four-county area (Elk, Forest, McKean and Warren counties). NVUM surveys suggest visitors value the ANF for a variety of recreational opportunities, including fall foliage viewing, driving for pleasure, viewing wildlife, picnicking, visiting a wilderness, hiking, photography, camping, hunting and fishing, boating, and gathering forest products.

As a third measure of the public's attitudes, beliefs and values, the public's comments received during the planning process provide insight into participants' views of ANF resources and their management. (See Appendix A for more detailed treatment.) Individual recreational users, such as equestrians and ATV riders, initially formed groups as social networks, or communities of interest. In some cases, there developed a more formal structure, longstanding habits of working together, and a willingness to partner with the ANF in various on-Forest projects. These efforts can be very effective with a focused agenda, though they sometimes tend to represent members in a fairly one-dimensional way, as purely snowmobile enthusiasts, equestrians, birdwatchers, or logging interests.

Key communities of interest have been very actively engaged in the planning process, but have taken distinct approaches to providing their ideas and comments. Some have engaged across all three major issue areas: vegetation management, habitat diversity, and recreation. Others have focused on very specific topics or locations, this is particularly true of motorized recreationists. Some of these have used formal organizations, such as industry associations or non-profit environmental advocacy groups, and have tended to submit more detailed, more formal proposals (see Chapter 2). And many have worked through loose networks of individuals, submitting individual comments, sets of similar or identical comments, or formal written comments supported by lists of individuals.

Key communities of interest include the following, divided by the major issue area:

Vegetation management

Advocates for increased timber harvest and more active management to promote forest health – the Allegheny Hardwood Utilization Group (AHUG) has demonstrated leadership.

Advocates for increased timber harvest for greater payments to school districts and townships – the Allegheny Forest Alliance (AFA) represents many local interests including some school districts, and several local elected officials have been very active.

Advocates of no timber harvest or harvest focused on restoration to promote forest health – the Allegheny Defense Project (ADP) was the principal advocate for this position.

Wilderness

Advocates for considerable additional wilderness – both the Friends of Allegheny (FAW) Wilderness and the ADP pursue this interest.

Opponents of additional wilderness designation – a number of groups have opposed additional wilderness as limiting forest management (AHUG), limiting multiple-use options (Allegheny Alive [AA]), and reducing timber and recreation revenues.

Recreation

Advocates for more motorized trails for ATVs – the Allegheny Trail Riders (ATR) have taken leadership among this community of interest.

Advocates for improvements to snowmobile trails, including connectors, less dual-use, and more trails – an association emerged to represent this community during the plan revision process (Allegheny Federation of Snowmobile Clubs).

Advocates for improved equestrian opportunities – the Pennsylvania Equine Council (PEC) has emerged as the leader of this community.

Advocates for more and improved non-motorized trails – several groups represent elements of this community, and ADP presented the most detailed proposal.

Habitat diversity

Advocates for increased forest openings for game species – the Ruffed Grouse Society (RGA) and the National Wild Turkey Federation (NWTF) represent this community.

Advocates for increased mature forest and connectivity for threatened and endangered species – The Nature Conservancy (TNC), the Western PA Conservancy (WPC), and ADP all represent these interests.

It is worth noting that one potential community of interest has not coalesced as a unified group, summer residents and those who own vacation homes, locally known as “camps.” Many of these properties have

been owned for decades by families, extended family groups, or in some cases groups of urban neighbors. Many of them are on a first name basis with Ranger District staff. They tend to express their property issues and other concerns directly, particularly during the season of highest use, mid-May to mid-September and in deer season in November and December. It appears that these stakeholders have worked through recreation group networks of ATV riders, equestrians, and others. The deer hunting community is perhaps the most dispersed and tends to focus its attention on the Pennsylvania Game Commission, which manages the deer herd in cooperation with landowners statewide. The principal cross-cutting issue for “camp” owners and seasonal residents is access, which takes two forms, roads on the Forest and direct off-road access. Generally, road management and maintenance, the number of roads, and location of them has not emerged as a plan revision issue, except with wilderness advocates and others who want fewer of them. Unfettered, direct access from individual properties for motorized recreation and equestrians has been raised in the context of those specific uses. Access is likely to be a concern with greater management of recreation.

In general, the public values the scenery, recreational opportunities, and natural setting of the ANF. Most value the multiple-use approach for forest management, and there is general agreement that forest health is supremely important to ecological sustainability of the ANF, although the meaning of forest health and how to achieve it remain topics of significant disagreement. Survey research data on attitudes, beliefs and values, supported by direct public comments during the plan revision process to date show a desire for: balanced management of resources to contribute to environmental, economic and social sustainability; a diversity of uses and opportunities for recreation; and increased opportunity for the public to understand the complexity of the Forest and its resources, and how the Forest is managed to contribute to environmental, economic and social sustainability of the region.

Civil rights and environmental justice

At present, the populations of the most directly affected areas, the Pennsylvania counties of Elk, Forest, McKean and Warren, are more than 95 percent white, non-Hispanics. Members of under-represented groups in more distant, largely indirectly affected areas may become more frequent users of the Allegheny’s recreational opportunities, as these are being marketed widely as part of the Commonwealth of Pennsylvania’s PA Wilds program to promote tourism based in outdoor recreation. Revision of the forest plan has engaged the Seneca Nation of Indians through government-to-government consultation, building on joint efforts relating to protecting their cultural resources.

Potential human health risks from herbicide use

The ANF is used by a variety of social groups engaged in activities ranging from recreation (e.g. hunters, campers, anglers) to income producing (e.g. timber industry, and oil and gas industry employees). Fuelwood gatherers, food gatherers (e.g. berries, mushrooms, leaks), and water users (e.g. of springs) also use the ANF. Private landowners who own lands within the proclamation boundary travel through, and quite frequently recreate on the ANF.

Herbicide treatment is an important reforestation tool for both even-aged and uneven-aged management. It was first used operationally on the ANF in 1987. Only ground application techniques are used on the ANF. Herbicides

have been used safely and effectively since then on the ANF on nearly 20,000 acres. No documented herbicide spills have occurred during operational use of herbicides on the ANF since the program was initiated in 1987.

Four years of water testing on the ANF found no detectable levels of herbicide downstream from areas treated to achieve reforestation objectives (USDA FS 1988, 1989, 1990, 2002). In 1998 and 1999, monitoring of herbicide treatments on powerline rights-of-way found the same results. Refer to the water resources section for additional information.

Direct and indirect effects

Scope of analysis

Effects on social conditions were analyzed for the four-county area. The bulk of social effects in the four-county area will be indirect. These will result from direct and induced economic effects working through local community structure and processes. Economic effects (impacts) are covered in the section on Economic Conditions.

Introduction to effects

Social effects will be treated parallel to the three descriptive sections above, population trends, lifestyles and social organization, and attitudes, beliefs and values toward land use patterns.

Population trends

Regarding population trends, no effects are anticipated on marital status, ethnicity or gender from revision of the LRMP. Slight changes to population trends and age cohort structure may result indirectly through direct and induced economic impacts resulting in changes to employment opportunities. A more noteworthy effect is likely to be that on education. This social effect, too, would be through economic impacts, especially direct payments to local government entities (school districts and townships) from ANF receipts.

Lifestyles and social organization

Regarding lifestyles and social organization, little effect is anticipated on family size or composition, which reflect large trends in U.S. society as a whole. Migration may be affected through economic impacts, particularly through changes to employment opportunities, and to a lesser degree through educational and recreational opportunities. Effects would most likely be among the 18-to-64-year-old age cohort. With increased employment and possibly educational opportunities for children in kindergarten through high school and more diverse, more user-responsive recreational opportunities, there may be greater retention and perhaps recruitment of individuals and heads of households from this key age cohort. These effects may extend beyond the four-county ANF core. The largest impact would be among those with existing economic or family ties to the region, some of whom might be attracted to return to their home region if they can meet their employment, income and educational expectations.

Attitudes, beliefs and values

Attitudes, beliefs, and values toward land use patterns may show effects from management choices made to determine the future direction of the ANF. Effects may extend beyond the four-county ANF region. Those most affected will be people with deep individual or group passions about and commitment to particular places on the ANF, to specific sets of values regarding various resources, and/or to specific uses of the Forest. It could be argued that these effects will diminish with distance from the Forest.

Civil rights and environmental justice

There is little to no evidence for differential impacts of changes associated with revision of the LRMP for the Allegheny National Forest that would affect racial or ethnic minorities, low-income groups, or others.

Potential human health risks from herbicide use

Potential herbicide effects on human health are reviewed and analyzed through a process called a human health risk assessment. The human health risk assessment for proposed herbicide use on the Allegheny National Forest is fully documented in Appendix G-1 of this FEIS. It includes a detailed description of the methods used on the ANF to apply herbicides, herbicide application rates, and a description of the ANF vegetation management programs that involve herbicide use (Section 2). The results of the risk assessment are summarized in the following discussion.

Source of information for the ANF risk assessment

Earlier human health risk assessments for the ANF were prepared in 1991 (USDA FS 1991a) and 1997 (USDA FS 1997c). They provide some information useful to this analysis, but since then more current national risk assessments have been completed independently for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA). These SERA assessments (SERA, 1997; SERA, 2003; SERA, 2004) are more consistent with contemporary approaches used by the Environmental Protection Agency (EPA) for this same purpose, and they cover the wide array of environmental conditions found on National Forests throughout the Nation. These risk assessments cover glyphosate, sulfometuron methyl, as well as several inert ingredients and surfactants. The ANF risk assessment relies heavily on the information presented in them and incorporates much of it by reference.

ANF standards, guidelines, and monitoring results also provide an important basis for assessing potential risks from herbicide treatment.

Description of the risk analysis technique.

Three major elements of the risk assessment include the following:

- The *hazard analysis* documents information about the basic toxic properties of the chemicals, and the levels of exposure (called the reference dose) that produce no observed adverse effect to humans (Sections 3 and 6, the “Dose Response Assessment” subsections).

- The *exposure analysis* quantifies the level of human exposure (workers and the public) expected from the proposed program of ANF vegetation management (Sections 4 and 7) and documents potential exposure from several potential accident scenarios.
- The *risk analysis* compares the reference doses with the ANF exposure to determine the level of human health risk (Section 5, Overview subsection). Risk is expressed as the hazard quotient, defined as the ratio of the exposure to the reference dose. If the exposure is less than the reference dose, then the hazard quotient is less than one and the risk falls within an acceptable range.

Stated another way, the assessment consists of comparing doses that people may get (as determined by the exposure analysis) from applying the herbicides (doses to workers) or from being near an application site (doses to the public) with doses that have produced no observed adverse effects in test animals in controlled laboratory studies (as determined in the hazard analysis). Risk judgments are based on the size of the ratio between the no observed adverse effect level (from the hazard analysis) and the estimated human dose (from the exposure analysis). When this ratio exceeds 100, there generally is little reason to be concerned unless the hazard analysis points to specific concerns for sensitive sub-populations, such as infants and children. This risk assessment looks at the potential human health effects from the active ingredient of each herbicide, and it also presents some information about the inert ingredients, formulated products, and surfactants.

Effects common to all alternatives

Population trends

The primary effect on population trends under all alternatives may be on education. Receipts to local governments under the 25 percent funds payments are expected to increase (see Economics above). Increased payments to school districts will allow them greater discretion in their budget processes, and this may in turn lead to greater emphasis on education generally, and higher expenditures per pupil and higher teacher salaries specifically. Three caveats are important here: higher expenditures do not necessarily mean more successful educational outcomes; payments projections assume that the ANF is sufficiently funded to achieve the timber outputs projected per alternative; and this will have no direct effect on education beyond the high school level.

Lifestyles and social organization

Recreation programming will be better prepared to offer over the course of the LRMP an array of opportunities more responsive to Forest user demand, which is likely to have a salutary effect on lifestyles. Once there are better data to assess trends specific to the Allegheny, the new methodology for monitoring visitor use will enable recreation planners and programmers to understand more fully current use patterns and to anticipate the public's desires. Other new techniques to analyze recreation impacts on resources, to provide GIS mapping of current conditions and make projections of future conditions, and to categorize recreational options will provide more tangible and targeted planning options. When these are coupled with national level recreation use research and demographic data, comprehensive planning can

more efficiently employ the resources of the Allegheny to meet recreational user needs and desires. By employing a more collaborative approach to recreation development, including closer work with partner groups and volunteers, the ANF can be more responsive to recreational users. And, the ANF is cooperating closely with the Commonwealth of Pennsylvania's significant program in tourism development through outdoor recreation, known as PA Wilds (see Recreation Opportunities and Forest Settings above).

Attitudes, beliefs and values

Sample surveys of attitudes, beliefs and values indicate that the public, both within the ANF four-county area and outside it, both rural and urban, rank their most important management requirements as: a) beauty and recreation; b) water quality; and c) fish and wildlife habitat, in that order. At the same time, the public ranks timber production and oil, gas and mineral production as their least important management requirements for the ANF. This dichotomy between protectionist uses versus utilitarian uses is generally the norm in the United States and other advanced post-industrial societies, but varies locally, depending on habits and what people are accustomed to. Generally, the threshold of tolerance for disturbance of the landscape is quite high in Pennsylvania, whether it is for surface coal mining, industrial agriculture, timber management, or oil and gas extraction.

Timber harvest to enhance forest health and to meet market demand for wood, and oil and gas drilling and production in response to market demand, are both anticipated to sustain increased activity under the revised plan. To the extent that trade-offs exist between the former set of protectionist management requirements and the latter set of utilitarian management requirements of the public, maintaining a socially optimal balance among these desires will be challenging. This delicate balance may be further exacerbated if tourist numbers increase from promotional programs such as PA Wilds. Expectation management may become difficult for ANF managers and their partners working in provision of recreational opportunities, as well as for their partners in local and state government and on-Forest operators in timber and oil and gas.

Potential human health risks from using herbicides

Glyphosate

The following discussion summarizes possible risks to the public and to workers from the proposed use of glyphosate for managing vegetation on the ANF. This includes scenarios covering application that occurs as *planned*, as well as scenarios that look at risks resulting from *accidental exposure* to the herbicides.

Public risks

The term "public" includes hikers, campers, food gatherers, anglers, hunters, fuelwood gatherers, Native Americans, oil and gas producers, timber operators, berry pickers, and other ANF users. Basically it includes all people who use or work in the ANF except those who work with the herbicide contract (see also the Summary on pages G1-1 and G1-2).

Appendix G1, section 5 of the ANF Human Health Risk Assessment (Tables 49-57) shows that the *planned use* of glyphosate using mechanical ground broadcast foliar, backpack foliar, or cut surface treatments on the ANF, even at the maximum exposure scenarios, should not affect (the risk is negligible) any member of the public, including sensitive individuals. This holds true for both the acute and the longer-term scenarios considered (Appendix G1, p.G1-89).

None of the acute *accidental exposure* scenarios evaluated exceed the level of concern, except for two of the maximum scenarios for cut surface treatment (see Tables 51, 54, and 57). These two are extraordinarily extreme and conservative scenarios that are used in all Forest Service risk assessments. The first scenario (hazard quotient equals 1.17 to 1.49) is for the consumption of contaminated water after an accidental spill of 5 gallons of undiluted solution into a small pond. This situation is extreme to the point of limited plausibility since a worker would use only .5 to 3.5 gallons of product during the course of an entire day. Even more unlikely is the second scenario, the direct spray of an unclothed child during a cut surface application that involves using backpack or hand-held equipment to treat an individual stem (hazard quotient equals 1.99-2.54). It is highly unlikely that all of the events necessary to produce either of these accidental doses would occur. The ANF has not experienced an accidental spill into a body of water nor an accidental spraying of any public user since the treatment program began in 1987 (Appendix G1, pp. G1-89 and G1-90).

Worker risks

The term “worker” includes all personnel involved in applying herbicides. The risk characterization comparisons in Appendix G-1 Section 5 (Tables 40-48) show that worker exposures should not exceed a level of concern for either the mechanical ground, backpack foliar, or cut surface applications, even at the highest exposure scenarios evaluated (Appendix G1, p.G1-80).

Sulfometuron methyl

Possible risks to the public and to workers from the proposed use of sulfometuron methyl for managing vegetation are summarized (see also the summary on pages G1-2 and G1-3).

Public risks

The term “public” involves the same categories of individuals mentioned above in the glyphosate discussion.

Section 8 of the ANF Human Health Risk Assessment (Tables 93-98) shows that the ANF *planned use* of sulfometuron methyl using mechanical ground broadcast foliar or backpack foliar treatments, even at the maximum exposure scenarios, does not exceed a level of concern for any member of the public, including sensitive individuals. This holds true for both the acute and the longer-term scenarios considered. The risks are negligible, just as they are for glyphosate (Appendix G1, pp. G1-140 and G1-141).

Worker risks

The term “worker” includes all personnel involved in applying herbicides.

The risk characterization comparisons in Appendix G1, Section 8 (Tables 87-92) show that worker exposures should not exceed a level of concern for either the mechanical ground or backpack foliar applications, even at the highest exposure scenarios evaluated. The simple interpretation of the quantitative characterization of risk to workers presented in Appendix G1 for sulfometuron methyl (as is also the case for glyphosate) is that even under the most extreme scenarios evaluated, workers would not be exposed to levels of sulfometuron methyl regarded as unacceptable, so long as reasonable and prudent handling and application practices are followed (Appendix G1, p.G1-134).

General risks of skin or eye irritation

Glyphosate, sulfometuron methyl, and their formulated products are skin and eye irritants. These types of effects (such as skin irritation) may occur after short-term exposure to unusually high levels of herbicide. Studies have shown these herbicides do not penetrate the skin immediately, but over a considerable period of time. Workers would have to ignore their own safety and not wash the chemical off their skin in order to receive the predicted dose. All ANF work sites have wash water available onsite, and all workers are trained in safety procedures. As with the handling of any chemical, including a variety of common household products, workers need to take reasonable care to avoid contact with skin and eyes.

Synergistic effects

Synergistic effects of chemicals are those that occur from exposure to two chemicals either simultaneously or within a relatively short period of time. Synergism occurs when the combined effects of two chemicals is greater than the sum of the effects of each agent alone. However, instances of chemical combinations that cause synergistic effects are relatively rare. Present scientific knowledge in toxicology indicates that an exposure to a mixture of pesticides is more likely to lead to additivity or antagonism, rather than synergism, when considering the toxicological effects of such a combination. EPA generally recommends using an additivity model when little information exists on the toxicity of the mixture and when components of the mixture appear to induce the same toxic effect by the same mode of action. Based on the limited amount of data available on pesticide combinations, it is possible, but unlikely that synergistic effects could occur as a result of exposure to a mixture of glyphosate and sulfometuron methyl (USDA FS 1991, Appendix A, Section 5-14 and 15, and FEIS Appendix G1, pp. G1-4 and G1-142).

Inert ingredients

Inert ingredients are chemicals used with the active ingredient that serve as a carrier for the active ingredient and facilitate effective herbicide application. They are not intended to supplement the herbicide's toxic properties. Data gaps exist regarding the toxic properties of inert ingredients and, therefore, formulated products. All of the inerts in the formulated products or surfactants considered for use on the ANF are on EPA inert List 3 or List 4b. EPA List 4b inerts are chemicals that the EPA concludes neither pose a toxicological concern nor are they reasonably considered to be toxic products (USDA FS, 1991, Appendix A, Section 3-13, and FEIS Appendix G1, pp. G1-36 and 37, and G1-101). List 3 indicates that there is unknown toxicity for inerts

where there was no basis for placing it on any of the other lists. For this analysis, we conclude data gaps regarding these inerts are not a primary concern because they are on EPA Lists 3 and 4b. In addition, since the risk posed by the herbicides’ active ingredients are overstated, any risk posed by the herbicides as formulated products is considered to be characterized by the analysis of the active ingredients. The formulations proposed for use on the ANF are similar to or less acutely toxic than their active ingredients (Appendix G1, Tables 9 and 59).

Effects from each alternative

Effects to social conditions from each alternative are best considered comparatively, in concert with the changes across alternatives. It is not anticipated that population trends will be affected directly and differentially from one alternative to another. Indirect effects may operate in tandem with economic impacts discussed above.

Lifestyles and social organization

Effects to lifestyles are both direct and worth discussion. As examples, those who feel that riding ATVs is an emotionally satisfying form of recreation or a recreation opportunity that is important for their business catering to ATV riders, will generally prefer the greater opportunities presented in Alternative B. They also would derive more satisfaction from Alternative B, were it fully implemented. Similarly, equestrians who favor no restrictions on their riding would probably prefer Alternative A. Those who prefer designated and marked trail riding only would have their needs met better by Alternative D, while those wishing options, say for family versus solitary riding, might achieve greater satisfaction from the implementation of Alternative B or C. And for those for whom the critical lifestyle impact is the “bottom line,” be it employment or income impacts driven by outputs of timber and forest recreational users, comparison across alternatives can be made from the table in the Economic section.

Table 3-125 suggests how some of the most active groups representing communities of interest may rank the four alternatives. Given the level of engagement in the plan revision process to date, we anticipate detailed comments from these communities of interest as individuals and through their organizations. Note that not all of the groups mentioned above are included here, as not all have interests that vary greatly across alternatives.

There are many active citizens who have a great lifestyle passion in their lives, one that may be reflected in one and only one of the elements that varies across the array of Alternatives. Evidence from public involvement in plan revision, from comments submitted to date, and from user surveys indicates that many people with a strong interest in the Allegheny are multi-dimensional in their interest.

Table 3-125. Possible rankings of alternatives by active interest groups

Community of Interest	Alternative A	Alternative B	Alternative Cm	Alternative D
AA and AFA	highest	high	medium	low
ADP	lowest	low	medium	high
AHUG	high	high	medium	low
ATR	high	highest	low	lowest
FAW	lowest	low	medium	high
NWTF and RFG	high	highest	medium	low
PEC	high	highest	medium	low
TNC and WPAC	lowest	low	medium	high

When in open-ended formats on surveys, at collaborative public meetings, or in informal situations, they generally express several desirable outcomes in concert with the Forest Service's multiple-use mandate. Many citizens, particularly those from the four-county ANF region, also often have practical considerations. These may include their occupations, a secondary source of income, or their hobbies. These make their lives more complex and more interesting, and they attenuate people's passions when these various interests are considered simultaneously. For the many citizens like these, the assessment of effects across all alternatives and from individual alternatives is far from transparent and obvious. As they seek balanced management, increased diversity of recreational opportunities, and greater understanding of the complexity of the Forest, they are likely to highly value and favor elements from several of the Alternatives, and therefore provide favorable and unfavorable comments and suggestions across Alternatives.

Effects to human health from herbicide use

The main variation between the alternatives would be in the number of acres treated per year (Table 3-31). During the next 20 years, Alternative D would involve treating 800 acres per year, slightly less than the average 1,000 acres/year that have been treated since 1987. Alternative A projects an average of 1,700 acres per year, whereas Alternatives B and Cm project slightly more, an average of 1,900 and 2,000 acres per year, respectively.

Mitigation to help ensure negligible human health risk

Even though public health risks are minimal, a number of mitigation measures in each alternative will help limit public exposure to herbicides. Some examples include the following:

- ANF personnel will alert people who are known to use specific forest areas where treatment is planned. Owners of nearby vacation dwellings or homes would be notified as well.
- For sites that contain active oil and gas equipment, ANF personnel will contact the operators prior to spraying so they have an opportunity to limit their exposure to herbicides, if they prefer.
- For sites with nearby trails or dispersed recreation use, posters at trailheads and along the trail will alert hikers when they are approaching the spray areas so they can avoid walking through them, if they choose to do so. In order to minimize contact with campers, areas in the vicinity of dispersed campsites or high recreation use areas would not be treated during holiday weekends.
- Some areas may adjoin roads that are open to public use. Signs would be posted at intervisible locations along the road to alert people that spraying has occurred. These signs will remain in place for at least 30 days following treatment.
- All herbicide label guidelines and safety precautions, including those related to worker safety, will be followed.
- During herbicide application, Forest Service personnel will be present at each treatment site to caution visitors to stay away from equipment and the treated area and to respond to their questions and concerns.

It is highly unlikely that the public would contact the spray mist or the sprayed vegetation, unless they choose to do so. Even if they do, the risk of it affecting them would be negligible.

Cumulative effects

The cumulative effects boundary will be the four-county ANF region. The time period will be 2006 to 2020. The cumulative effects of the group of alternatives taken together and of the individual alternatives singly on social sustainability are essentially indeterminate. The four-county region of the ANF is very much linked to the U.S. and, in many respects, to the global economy, as demonstrated by the increased demand and price for oil and gas. The most important cumulative effects will be those that work through the economy from timber management and the productive health of the Forest, outdoor recreation opportunities and the possible further development of the area for tourism, and the growth of oil and gas extraction, a very cyclical industry. Regional and national trends in demographics and migration have played out in the region over the past decades, and the four-county region resembles other relatively remote rural areas at the outer fringe of urban influences, but subject to strongly cyclical natural resource demands. In the recent past, neither of these strong macro-level influences has worked in favor of the four-county ANF region.

It could be said that macro-level changes in attitudes, beliefs and values have also played out in the region. This has spawned considerable controversy regarding the management of the Forest for multiple uses, including timber production, the proper balance of these several uses, and the relationship of the Forest to the region and to the larger system of public lands. Changes in lifestyle preferences have also been evident in the shifting patterns of recreation uses, some of which are coupled with an aging population and some of which are purely tastes and preferences of people. The cumulative effects on social sustainability will be shaped largely by the interaction of these larger forces (economic, demographic, lifestyle choices, and attitudes, beliefs and values) and the response to them through the joint efforts of the Forest's regional partners and the Forest's management team.

Likely areas of cumulative effects include the impact of tourism development activities based on promotion of outdoor recreation by the Commonwealth of Pennsylvania, the increased numbers of retired people and the amenities they seek for their retirement years, and the potential for expansion and intensification of oil and gas extraction. Each of these has the potential to bring about social or socio-cultural change in the four-county ANF region.

Effects from PA Wilds program and people attracted to the area

In the past 25 years there has not been a comparable tourism promotion program in this area. Promotion of tourism by the PA Wilds program is being avidly embraced by some communities and some business interests, even while being regarded with disdain and fear by others. This is not uncommon, nor is it irrational on the part of either group. Outdoor recreation is highly valued by many in the ANF region and sharing it with others who may value it in a different way, or who have different expectations about how to enjoy it, presents challenges. Major influxes of tourists, even high value-added, low-impact tourists who are the target of PA Wilds efforts, can require significant changes for businesses catering to them and to those sharing the resource, whether it is a favorite section of trout stream or a scenic overlook. Tensions between tourists (outsiders to residents) and residents (locals to tourists) can be very uncomfortable for both, for long periods of time.

Some very successful tourism development schemes, successful in terms of attracting large numbers of tourists and their spending, have seen long-term cultural changes in the area where they are focused and have produced an influx of new permanent residents. These in-migrants are often motivated by a scenic setting, a quieter lifestyle, outdoor recreational opportunities, a lower cost of living, or a business opportunity not realized by residents. These can be people of any age with skills or talents that permit them to be “footloose,” i.e., not tied to any particular place to carry out their employment, as well as retirees seeking the same setting to enjoy at their leisure. In the future, there is likely to be more of both of these migrant folks, as well as people living elsewhere who have ties to this area from having grown up here. Whether or not a promotional program such as the PA Wilds will be sufficient to attract them to visit to recreate, or if diversification of the region’s economic base can provide the amenities to attract them to stay longer, remains to be seen. It is important to consider that tourism can complement the present economic base by providing additional seasonal or niche market employment and markets for traditional small businesses, such as wood workers.

Effects from private oil and gas development

The last potential set of cumulative effects stems from the fact that the mineral rights under 93 percent for the Allegheny are owned by private individuals or companies and that we are in the midst of a very large upsurge in the cycle of oil and gas extraction (see Appendix F). Projected levels of new oil and gas wells are double that level the area has experienced since 1986. Such an upsurge produces an upsurge in activity in the field, re-opening capped wells, drilling new wells in or near already developed areas, and opening new areas to develop, with new road construction, site clearing, and drilling. There is evidence that many local residents and long-term Forest users are frustrated with this burst of activity. (It must be noted that this phenomenon is not limited to the Forest, but is also true of private landowners, including some large timber companies.) How long this will take to play out and what its final impacts will be on the resources and the population are yet to be seen. This does not appear to be auspicious for meeting the expectations of new outdoor recreationists attracted by PA Wilds promotion. Managing these new visitors and their expectations may prove very challenging for ANF management and their partners in this effort.

Effects from herbicide use

In any alternative evaluated here, cumulative effects are not likely because there is no indication that repeated exposures from planned use of herbicides will exceed the threshold for toxicity (Appendix G1, Sections 5 and 8, cumulative effects subsection). It is possible and even likely that some individuals will be exposed to multiple sources of herbicides (particularly glyphosate) as a result of ANF programs, other programs (treatment of private land, homeowner use, rights-of-way, etc.), and exposure to glyphosate in crop residues. However, the use of herbicides on the ANF is not likely to substantially increase an individual’s potential exposure to these herbicides from the other sources (Appendix G1, Sections 5 and 8).

3.5 Resource Commitments

This section contains effects disclosures that are required by federal law, regulations, or policy, and that generally apply to all the preceding resource area effects sections in this chapter associated with the proposed federal actions. Forest Plan revision and Forest Plans do not directly implement any management activities; however, establishment of management emphasis and direction for implementation activities are made.

3.5.1 Unavoidable Adverse Effects and Mitigation

The application of forestwide standards and guidelines and resource protection measures would limit the extent and duration of any adverse environmental effects. Nevertheless, some adverse effects are unavoidable. For detailed disclosure of all effects, including unavoidable adverse effects, see the preceding Environmental Consequences discussions for each resource area in the physical, biological and social sections of Chapter 3. It is important to note actual effects do not occur until project-level decisions are implemented.

This section describes those adverse effects that may not be avoided when project decisions are made to implement the LRMP. Implementation of any of the alternatives would generally move the landscape and ecosystem towards identified desired conditions, but adverse environmental effects may occur even with standards and guidelines to control the effects. The most notable unavoidable effects when project-level decisions are made are summarized below.

Physical

Increased erosion and sedimentation from soil disturbances associated with timber harvesting, road construction, recreation use and facilities construction (including trails). Effects from roads can be long-term, whereas effects from skid trails and landings are generally short-term. Loss of soil productivity occurs through loss of landform from road construction and mineral pit development.

Biological

Even-aged management on the Allegheny National Forest involves treatment of herbicides to control undesirable vegetation. Individual non-target plants or understory woody species within specific project sites would be killed. The degree to which herbicides affect non-target plants varies by herbicide, time of year applied, and method of application. Foliar spraying with glyphosate will kill most tree seedlings or herbaceous plants that have green leaves at the time of spraying. Sulfometuron methyl will not harm, or may cause only slight damage, to many tree seedlings present on the site when it is applied after September. Herbicide treatments will temporarily displace individual songbirds and small mammals to adjacent areas when target understory vegetation is killed.

Road construction and stone pit development will alter natural landforms and result in loss of overstory vegetation and wildlife habitat.

Social

Activities, such as timber harvest and road construction, may temporarily disrupt recreational uses. Other activities, such as road closures, may permanently reduce or change the opportunities available. Some kinds of developments (such as hiking trails) or activities (such as motorized recreation use) may displace other recreation uses that are incompatible and create user conflicts.

Herbicide treatment temporarily affects visual quality by turning vegetation brown. This affect is short lived, since most herbicide treatment would occur close to the time when fall foliage color change occurs, and new vegetation rapidly begins to re-occupy treated areas the following year.

3.5.2 Relationship Between Short-term Uses and Long-term Productivity

Short-term uses are those expected to occur in the first decade, including recreation use and development, timber harvest and associated reforestation activities, and access development and management (FS roads). Although these uses are not directly implemented by the LRMP, the potential for these uses are described in LRMP goals and objectives, both at the forestwide and management area levels (see Chapters 2 and 3 in the LRMP).

Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the planning period. Minimum management requirements prescribed by the Forestwide standards and guidelines will be met under all alternatives. Minimum requirements assure that long-productivity of the land will not be impaired by short-term uses.

Monitoring and evaluation, as described in the LRMP (Chapter 4), apply to all alternatives. A primary purpose of monitoring is to ensure that long-term productivity of the land is maintained or improved. If monitoring and evaluation show that LRMP standards and guidelines are inadequate to protect long-term productivity of the land, then the plan will be adjusted (through amendment or revision) to provide more protection or fewer impacts during project implementation.

Although all alternatives are designed to maintain long-term productivity, there are differences among the alternatives in the long-term availability or condition of resources. There may also be differences among alternatives in long-term expenditures necessary to maintain or achieve desired conditions. The differences are discussed throughout the various sections of Chapter 3.

3.5.3 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources are defined in Forest Service Handbook 1909.15, Environmental Policy and Procedures (7/06/2004).

Irreversible is a term that describes the loss of future options. It applies primarily to the effects of use of nonrenewable resources, such as material minerals (stone pits) or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as winter sports site. The production lost is irretrievable, but the action is not irreversible. If use changes, it is possible to resume timber production. When one alternative produces less of a natural resource (such as timber volume) or offers fewer opportunities for use (such as motorized recreation) than another alternative, the difference represents an irretrievable commitment of resources.

Decisions made in a forest plan do not represent actual irreversible or irretrievable commitment of resources. A forest plan determines what kind and levels of activities are appropriate on the Forest; it does not make site-specific or project decisions. The decision to irreversibly or irretrievably commit resources occurs:

- When the Forest Service makes a project or site-specific decision
- At the time Congress acts on a recommendation to establish a new Wilderness or to include a river in the Wild and Scenic river system

Examples of irretrievable resource commitments associated with project-level decisions that implement the LRMP are:

- Opportunities for non-motorized recreation, solitude, and primitive or wilderness experiences would be foregone when projects are implemented for other purposes
- Timber volume outputs would be foregone on land determined as not suitable for harvest.
- Opportunities to maintain or produce a specific vegetation condition are foregone for some period of time so that another vegetation condition may be produced in its place, such as through silvicultural prescriptions and the use of herbicides
- Commodity outputs would be reduced or foregone on areas where specific uses are implemented, such as developed recreation areas
- Non-commodity values, including scenic resources, may be reduced or foregone in areas where commodity uses are implemented
- To the degree that an action preserves or encourages the development of mature and old-growth habitat, opportunities to develop early structural habitat would be reduced (The reverse is also true, to the degree that an action preserves or encourages the development of early structural habitat, opportunities to develop mature and old-growth habitat would be reduced.)

3.5.4 Energy Requirements and Conservation Potential

Energy is consumed in the administration of natural resources on the Forest. The main activities that consume energy are timber harvest and associated reforestation activities (prescribed fire), recreation use, road construction and maintenance, and administrative activities of the Forest Service and other regulatory agencies. Energy consumption is expected to vary only slightly by alternative. Alternatives with higher potential for timber harvest and/or road construction, reconstruction, and obliteration are expected to have somewhat higher levels of energy use. Based on that assumption, Alternative A would likely have the highest energy use, followed by in descending order by Alternatives B, C, and D.

Several opportunities exist under all alternatives to provide for energy conservation or conversion from less plentiful fuels to more plentiful fuels.

3.5.5 Conflicts with Other Agency or Government Goals or Objectives

For the most part goals and objectives in the LRMP complement and support those of surrounding government entities and the County Comprehensive Plans referenced below. Most of the contents within the LRMP are refinements of the 1986 Forest Plan, which has been under implementation for over 20 years.

Although the DEIS did not list any conflicts, the following limited conflicts with county goals and objectives are added in the FEIS. They are stated in the County comprehensive Plans as noted. These plans were written over different time periods so a brief overview on commonality within each county as it relates to the ANF is provided.

Economic development is a high priority in each county. Job creation in forest products, tourism, and recreation are expectations of science based, multiple-use management on the ANF. The economic development zones identified are all in areas with existing or mixed private ownerships along major road corridors (with exception of the Kinzua Resort, identified by Warren County mentioned below). There is no identified conflict over any specific economic development proposal. In summary, they would like to see additional recreation opportunities, protection of forest amenity values, and Elk, Forest, and Warren County Plans advocate increasing ANF timber harvest levels (Zinn, 2006).

Potentially conflicting goals, objectives, or concerns in county comprehensive plans

1. Elk County 1999 Update of the 1968 Comprehensive Plan (Elk County Commissioners, 1999). The Ridgway Borough Water Works and Johnsonburg Municipal Authority list concerns for quality and quantity of future water supplies to service their needs from two watersheds located largely on the ANF. Nothing specific about ANF management is mentioned in these general statements.
2. Forest County Comprehensive Plan 1998 (Forest County Conservation District and Planning Commission, 1998). Concerns over the level of ANF land ownership and the trend of acquisitions since the first county plan in 1975 is expounded, as it relates to a reduced and unreliable tax base. A map featuring a “public land growth boundary” is contained. The following goals and objectives pose potential conflict with the LRMP:
 - Forest County should continue to seek ways to control and mitigate the effects which occur through the conversion of private lands to public.
 - Forest County should continue to explore, and adopt, appropriate policy measures which would result in a “No Loss of Private Property” standard within the County.
 - Use of National Forest land should be appropriate, and where needed, regulated to protect its value as a total community resource. Greater effort should be made to enter into cooperative management arrangements to offer local opinion and input regarding usage of National Forest lands within Forest County and to explore, in frank and realistic ways, the impacts endured and absorbed by Forest County citizens (p. 8).

3. Multi-Municipal Comprehensive Plan for McKean County 1977 (McKean County Planning Commission, 1977) and the Tuna Valley Council of Governments Multi-Municipal Comprehensive Plan 2001 (City of Bradford, and Bradford, Foster, Lafayette, and Lewis Run Townships, 6/2001). Although some industrial and commercial development areas are listed adjacent to ANF lands no concerns or specific conflicts are listed.
4. Warren County Comprehensive Plan Update 2005 (Warren County Planning and Zoning Commission, 6/2005). The following statements are presented to point to areas of potential conflict as the LRMP is implemented:
 - “Although both the Kinzua Dam/Allegheny Reservoir complex and the ANF are located in Warren County, there is little local input into the development, or operation of these resources – resources important for local recreation opportunities and for economic development. This should, and must, change.” (p.87)
 - “ANF Management Plan – Special Note: Between the ANF, the State Game Lands, and Chapman Park, approximately 30 percent of all land in Warren County is under public ownership. A formal policy of County participation in further acquisition decision by these bodies is essential.” (p.107)
 - “One prime local deficiency is the lack of a lodge in the Kinzua Dam area. Currently, that key facility’s resources are aimed at the outdoor camper or day visitor. A lodge could attract the overnight traveler. Overnight travelers represent a key increase in tourist spending, important for local tourist-related businesses. Typically, lodges on Army Corps of Engineers facilities are based on a 25-year lease. The first step is a feasibility study for such a unit.” (p.97)

These conflicts are not considered as barriers to further productive relationships with County planners or commissioners. The following Goals and Objectives responsive to these conflicts are listed below and contained in the LRMP:

- Collaborate with county and local governments to ensure that land adjustments benefit both federal and local interests (Goal p.17).
- Maintain or restore watersheds and their associated stream and groundwater processes, channel stability, riparian resources, and aquatic habitats to a functional condition. Provide quality, quantity, and duration of stream flow to maintain levels that support desired aquatic species or the most restrictive beneficial use (Goal p.16).
- Complete a management plan for the area surrounding the Allegheny Reservoir including that portion of the National Recreation Area (Objective p.19).

No other major conflicts between this Forest Plan revision effort and the stated goals and objectives of other governmental entities are known. Project level proposals during implementation of the LRMP will allow additional public involvement opportunities for decision makers to consider any specific associated controversy in these areas.

Chapter 4

List of Preparers



Photo courtesy of US Forest Service

This page intentionally left blank.

4 LIST OF PREPARERS

The preparation of the FEIS and the LRMP has been a major undertaking. A team of FS associates representing a broad spectrum of disciplines was responsible for writing and compiling the planning documents. The ideas and philosophy that guided the team came from the public and from other FS associates who worked with them. Their preparation could not have been completed without the support and assistance of our colleagues in the Regional Office and every employee of the ANF, particularly the program managers. We also recognize the Forest Leadership Team as providing instrumental guidance during this process.

4.1 Interdisciplinary Core Team

Name	William J Connelly
Position	Forest Planning Staff Officer
Education	B.A. Social Studies, Denison University, 1971; M.S. Economics, University of Oregon, 1981
Experience	25 years with USFS primarily in planning, analysis and budgets; Economist, Program Analyst, Umqua National Forest; Operations Research Analyst, Program Analyst, Pacific Northwest Regional Office
Contribution	Leadership and economic analysis
Name	Mike Antalosky
Position	Forest Fire Management Officer
Education	B.S.F. Forest Resources Management, West Virginia University 1975, M.S.F. Disturbed Land Reclamation/Silviculture, Stephen F. Austin State University 1977
Experience	27 years with USFS; Timber Sale Administration, NEPA Coordinator, District Recreation Manager, Soil & Water Program Manager, Dispersed Recreation Specialist, District Fire Management Officer, Forest Planner, Plan Revision Team Leader, Fire Management Officer
Contribution	Wildland fire suppression, fuels management, prescribed fire and mechanical fuels treatments, wildfire prevention
Name	Jim Apgar
Position	Forest Environmental Coordinator
Education	B.S. in Forest Management, University of Massachusetts
Experience	Silviculturist, Timber Management Assistant, Off Highway Vehicle Trail Planner, Planning and Design Leader
Contribution	NEPA Coordinator
Name	Mike Bowmaster
Position	Land Surveyor
Education	High School
Experience	35 years surveying
Contribution	Information about lands and special uses as requested

Name **David A Drake**
Position Resource Information Specialist
Education B.S. State University of New York, College of Environmental Science and Forestry, dual major Forest Biology/Resource Management
Experience 17 years with Forest Service; 10 with FIA, 7 with the Allegheny National Forest
Contribution Database/technical support

Name **Laura E. Drake**
Position GIS Specialist
Education BS in education, Edinboro University
Experience 23 years working for the Forest Service; 19 as a computer specialist, 4 as a GIS specialist
Contribution GIS support

Name **Lori Elmquist**
Position Planning Assistant
Education BS Communications, Clarion University
Experience 6 months with U.S. Forest Service
Contribution Planning record/administrative support

Name **Cara Farr**
Position Soil Scientist and Air Quality Specialist
Education B.S. in Environmental Protection (West Virginia Univ.)
 M.S. in Soil Science (West Virginia Univ.)
Experience Temporary Soil Scientist Monongahela National Forest 9 months; Soil Scientist and Air Quality Specialist Allegheny National Forest < 1 year.
Contribution Soil and Air input

Name **Jack A Frank**
Position Forester
Education B.S. with Honors, Forest management, 1977, Cook College/Rutgers University
Experience 26 years as a forester for the USDA Forest Service
Contribution Inventory data cleaning, update and selection for analysis; development of forest vegetation growth and yield tables

Name **Rick Fox**
Position Forest Plan Analyst
Education B.S., U.C. Berkeley, 1995; M.F.S., Yale University, 2001
Experience ANF employee (planning) since 2003; various non-profit and academic work experience in international forestry and resource management policy 1993-2003
Contribution Responsible for analytical methodologies and overall technical quality of the revision process until August 2004

Name **Michael Hampton**
Position Forest Ecosystem Management and Planning Staff Officer (former)
Education B.S. Forestry, Southern Illinois University
Experience 27 years with USFS
Contribution Leadership and guidance through November 2004

Name	Jeanne Hickey
Position	Resource Information Specialist (Geographic Information System-GIS)
Education	B.S. Environmental Science and Forest Biology, SUNY College of Environmental Science and Forestry; M.S. Wildlife Science, Cornell University
Experience	15 years experience in natural resources field. Six years with various agencies including the New York State Department of Environmental Conservation, New York Cooperative Fish and Wildlife Research Unit at Cornell University, and Cornell University. Nine years with U.S. Forest Service in various positions including timber cruiser, biological science technician, wildlife biologist, NEPA writer, GIS specialist (present).
Contribution	GIS data development and summaries, GIS analysis and mapping
Name	Andrea Hille
Position	Assistant Forest Silviculturist
Education	B.S. Natural Resources Management; Continuing Education in Hardwood Silviculture, Forest Health Topics, and Ecosystem Management; Recreation Planning Short Course, Clemson University; Completed USDA Forest Service Eastern Region Program for Advanced Studies in Silviculture
Experience	18 years USDA Forest Service; Silviculture, reforestation, recreation and wilderness planning, special uses; Certified Silviculturist in USDA Forest Service Region 9 for 7 years; Certified Pesticide Applicator
Contribution	Participated in development of treatment prescriptions, associated reforestation cost data, and standards and guidelines relative to vegetation management and pesticide use; Assisted with Herbicide Risk Assessment; Prepared Rationale for Vegetation Management Appendix and Vegetation and Forest Products portions of FEIS.
Name	Linda Houston
Position	Forest Geologist
Education	BA, University of Rochester
Experience	23 years experience. Minerals and Geology Management, Forest Planning, Hazmat, Project Management
Contribution	Technical programmatic input
Name	Edward L Huffman
Position	Soil Scientist and Air Quality Specialist
Education	M.S. in Watershed Science (Colorado State Univ.), B.S. in Forestry (Michigan Technological Univ.)
Experience	USDA Forest Service Soil Scientist since 2001; University Soils Research 1999-2001
Contribution	Provided Soil and Air input and analysis to the planning process

Name	Clare Hydock
Position	Botanist
Education	Associate Degree in Wildlife and Recreation Management, 1989, Hocking College. Bachelor's Degree in Range Management, 1992, University of Wyoming.
Experience	16 years experience in working as a Park Ranger, Range Technician, Rangeland Management Specialist, and Botanist. Worked for the National Park Service, Bureau of Land Management and USDA Forest Service.
Contribution	Species Viability Evaluations for threatened, endangered, and sensitive plants.
Name	Arnie Irvine
Position	Reality Specialist
Education	B.S. in Forest Science, some post graduate
Experience	31 years USFS, primarily as a resource planner, special uses, retired 2005
Contribution	Telecommunications sites, special use input
Name	Rick Kandare
Position	Forest Archaeologist/Heritage Resource Program Manager
Education	1974 A.A.S. in Liberal Arts and Social Sciences Niagara County Community College; 1976 B.A. Anthropology University at Buffalo; 1983 M.A. Anthropology University of Arkansas
Experience	Member of the Register of Professional Archaeologists (RPA) since 1983; over 25 years of experience in archaeology including 16 years with the USFS
Contribution	Heritage resources
Name	Charles M Keeports
Position	Forest Hydrologist
Education	B.S. in Environmental Science with emphasis in water resources, Susquehanna University, PA
Experience	Hydrologist with Bureau of Land Management in Elko, Nevada, 4 years; USFS, 1 year
Contribution	Water Resources and Riparian Management
Name	Carol LoSapio
Position	Technical Publications Writer-Editor (USDA FS CAT Publishing Arts)
Education	Technical communications with a minor in information technology, Colorado State University
Experience	14 years with the Forest Service, 10 years operating a writing, editing, and desktop publishing business, and 7 years with USDA APHIS Center for Epidemiology and Animal Health
Contribution	Document editing and layout/print preparation
Name	Dennis E Mattison
Position	Planning Assistant
Education	IT Certificate – Pitt Bradford
Experience	2 years with Forest Service as Planning Assistant
Contribution	Chapter 4 and 5 of DEIS; Appendix A of DEIS

Name	Barbara McGuinness
Position	Forester
Education	B.S. Environmental Forest Biology/Resource Management, SUNY College of Environmental Science and Forestry; M.S. Ecology, Penn State University
Experience	11 years technology transfer, communications, and writing/editing for Northeastern Research Station
Contribution	Document editing and layout
Name	Stephen K. Miller
Position	Public Services Staff Officer
Education	B.A. Liberal Arts, Pennsylvania State University, 1970; M.S. American Studies, Pennsylvania State University, 1979; M.P.S. International Agriculture and Rural Development, Cornell University, 1982; Ph.D. Rural Sociology, Pennsylvania State University, 1992
Experience	Has over 15 years of senior management experience in Federal government and academia, and 20 years practice in economic and social development and natural resource management. His technical expertise and consulting experience include: community and economic development; sustainable and participatory natural resource management; and, design, implementation and evaluation of development projects and programs.
Contribution	Integral in the public involvement process; Social conditions analysis
Name	April Moore
Position	Ecologist
Education	BS Biology - MS Biology
Experience	3 years as PFT
Contribution	Botany/Habitat Diversity/Species Viability Evaluation/Alternative Development
Name	Brad Nelson
Position	Wildlife Biologist
Education	BS In Animal Science, University of Maryland; MS in Wildlife Management, Frostburg State University
Experience	1986 to present, Forest Wildlife Biologist, Allegheny National Forest; 1981 – 1986, District Wildlife Biologist, Bureau of Land Management, Rawlins, Wyoming; 1979 – 1981, Endangered Species Biologist, Bureau of Land Management, Alexandria, Virginia
Contribution	Interdisciplinary Team Member – Habitat Diversity, Species Viability Analysis, Threatened and Endangered Species Consultation
Name	Brent Pence
Position	Fisheries Biologist
Education	A.A.S. Recreation and Wildlife Management; B.S. Fisheries Resource Management
Experience	19 years fisheries and aquatic resource mgt., including hydrology duties; member of a helitack firefighting crew; member of a stand examination crew; member of a timber marking crew.
Contribution	Team member working on Species Viability Evaluation, with Aquatic Species; Assisted with development of Standards and Guidelines for fisheries, riparian, and other aquatic resources; Assisted with the development of desired condition, objective, and goal statements for aquatic resources; Contributed to the affected environment and effects analysis write-ups for aquatic resources

Name	Scott Reitz
Position	Wildlife Biologist
Education	A.A.S: Natural Resource and Conservation, B.S.: Wildlife Science, Graduate and Undergraduate course work in Fisheries and Range Science, Continuing Education in Wildlife and Ecosystem Management
Experience	27 years experience with USDA Forest Service in wildlife and range management
Contribution	Conducted Species Viability Evaluation; helped develop Standards and Guidelines

Name	Dan Salm
Position	Forest Engineer
Education	MSCE - transportation systems, BSFE, AAS - Electronics Technology
Experience	25 years - FS Transportation Planning
Contribution	Long term Transportation System Planning and Analysis

Name	Kate Salm
Position	Public Affairs SCEP Intern
Education	M.A. English/Technical Communication; B.A. English Literature
Experience	6 months as SCEP; currently Public Affairs Specialist on the Huron-Manistee National Forest; Advertising Department-Special Promotions at Warren Times Observer
Contribution	Document design and minor edits of AMS; assisted with public meetings; assisted with planning of public meetings/workshops/tours

Name	James Seyler
Position	Planning and Design Team Leader (Bradford District)
Education	BS Environmental Forest Biology and Natural Resource Management, SUNY ESF 1995
Experience	9.5 years as a Biologist/Environmental Planner
Contribution	Bradford District Liaison

Name	William A Snyder
Position	Forest Plan Analyst
Education	M.S. – Biology
Experience	Former College Instructor, Former Department of Environmental Protection Air and Water Quality Specialist
Contribution	Spectrum Model Designer, Analyst, and Coordinator for Appendix B of the EIS

Name	Janet Stubbe
Position	Forest Landscape Architect
Education	B.S. Natural Resources Department of Landscape Architecture, University of Wisconsin
Experience	14 years Landscape Architect, USDA Forest Service, Warren, PA; 12 years Landscape Architect for Landscape Architect and Consulting Engineers, Wheaton, IL
Contribution	Scenery, including the inventory and analysis of scenery using the Scenic Management System (SMS)

Name	Peter Taylor
Position	Natural Resource Analyst
Education	B.S. Biology, College of William & Mary, 1999; M.F./M.E.M. Forestry and Environmental Management, Duke University, 2006
Experience	4 months experience with USFS in document writing and preparation; 2 years experience in university biological research and document preparation
Contribution	Coordinate the preparation of Appendix A of the FEIS
Name	Pamela Thurston
Position	District Wildlife Biologist
Education	B.S. in Wildlife ecology; 1 year graduate school in secondary education; PA and NY board certified for secondary education
Experience	1 year high school teacher in NY school system, 17 years with the Forest Service Species viability evaluations for amphibians and reptiles, parts of corridor analysis, management area objectives, ecological context and misc. reviews
Contribution	
Name	Kevin Treese
Position	District NEPA Coordinator
Education	B.S. in Forest Science with emphasis in Silviculture
Experience	20+ years in timber and land management
Contribution	District NEPA Coordinator
Name	Karl Vester
Position	NEPA Analyst
Education	B.A. Journalism and B.S. in Resource Conservation, The University of Montana
Experience	2 years USDA Forest Service
Contribution	Writer/Editor on Forest Plan
Name	Wendell Wallace
Position	GIS Program Leader
Education	Bachelor of Science, University of Minnesota - College of Forestry Associate in Arts, Vermilion Community College, Ely Minnesota
Experience	Two years in Fire Management with Minnesota DNR and Superior National Forest USFS; Three years Forestry Management with Chequamegon National Forest USFS; Seven years Mineral Management with Allegheny National Forest USFS; and 17 years Geographic Information Specialist with Allegheny National Forest USFS.
Contribution	Assisted resource specialists in using the Allegheny's geographic information system to provide a spatial framework for analyzing resource information. Produced map products for internal and external use to display alternative, decisions and outcomes developed in the planning process
Name	Robert W Wetherell
Position	Recreation and Special Areas Program Manager
Education	B.L.A. University of Georgia
Experience	16 years practicing Landscape Architect/Recreation Planner
Contribution	Developed Recreation, Dispersed Recreation, and Trail Analysis

Name	Robert White
Position	Forest Silviculturist and Pesticide Use Coordinator
Education	B.S. Forest Science; USDA Forest Service Program for Advanced Studies in Silviculture; Certified Silviculturist in USDA Forest Service Region 9 for 25 years; Tech. training in pesticide use; Certified Pesticide Applicator
Experience	32 years USDA Forest Service: timber, wildlife, policy analysis, program analyst in land management planning, oil and gas management; one of the principal authors of numerous documents (including the 1986 Forest Plan)
Contribution	ID Team Member; Participated in Analysis and Development of various topics related to Forest Vegetation Management including: Treatment prescriptions, growth and yield, standards and guidelines for management, rationale for vegetation management. Analysis of Management Situation, and the Human Health and Wildlife Risk Analyses for Herbicide Use

Name	Cat Woods
Position	Recreation Planner
Education	B.S. Natural Resources Management, Oregon State University
Experience	Six years Research Technician, PNW Forestry Sciences Laboratory, Corvallis, Oregon; 15 years Recreation Planner/Wilderness Manager/Cave Specialist, Thorne Bay, Alaska; two years Recreation and Wilderness Staff Officer, Hiawatha National Forest; three years Recreation Planner, Allegheny National Forest
Contribution	Analysis related to Recreation Resources and Congressionally designated areas(Wilderness, Wild and Scenic Rivers, National Recreation Areas)

4.2 Forest Leadership Team

Name	Kathy Albaugh
Position	Administrative Officer
Name	William Connelly
Position	Planning Staff Officer
Name	Lois Demarco
Position	Ecosystem Management Staff Officer
Name	Rob Fallon
Position	Marienville District Ranger
Name	Kathe Frank
Position	Forest Budget Officer
Name	Gary Giger
Position	C & M Work Supervisor
Name	Dan Salm
Position	Engineering Staff Officer
Name	Stephen K Miller
Position	Public Affairs Officer & Human Dimensions Officer

Name	Kathy Mohney
Position	Administrative Assistant
Name	Kathleen Morse
Position	Forest Supervisor
Name	James Seyler
Position	Acting Technical Services Staff Officer
Name	Robert Stovall
Position	Acting Bradford District Ranger
Name	Jody Vanselow
Position	Acting Deputy District Ranger (Bradford)

4.3 Other Major Contributors

Name	Gary Dixon
Position	Vegetation Simulation Group Leader
Location	WO-Detached Units, Forest Management Service Center, Fort Collins, CO
Contribution	Assisted by modifying the Northeastern TWIGS Variant of the Forest Vegetation Simulator program
Name	Rickard Hokans
Position	Regional Analyst
Location	RO, Milwaukee, WI
Contribution	Economic Analysis
Name	Bruce Meneghin
Position	GIS Analyst
Location	WO-Detached Units, Forest Management Service Center, Fort Collins, CO
Contribution	Assisted with the Spectrum model
Name	Don Vandendriesche
Position	Growth and Yield Support Programmer
Location	WO-Detached Units, Forest Management Service Center, Fort Collins, CO
Contribution	Assisted with the development of the Forest Vegetation Simulator growth and yield model

Chapter 5

Environmental Impact Statement Recipients



Photo courtesy of US Forest Service

5 ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

5.1 Agencies Consulted and Receiving Documents

5.1.1 Federal Agencies

Bureau of Land Management
Environmental Protection Agency
National Park Service
Natural Resources Conservation Service
U.S. Geological Survey
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
USDI: Office of Environmental Policy Compliance Director

5.1.2 Native American Tribal Governments

Absentee-Shawnee Tribe of Oklahoma
Cayuga Nation
Delaware Nation of Oklahoma
Eastern Shawnee Tribe of Oklahoma
Oneida Indian Nation
Onondaga Nation
Seneca Nation of Indians
Seneca-Cayuga Tribe of Oklahoma
Stockbridge-Munsee Band of the Mohican Nation of Wisconsin
St. Regis Mohawk Tribe
Tonawanda Seneca Nation
Tuscarora Nation

5.1.3 State Agencies

PA Department of Environmental Protection
PA Fish And Boat Commission
PA Game Commission
PA Department of Conservation and Natural Resources
NY Allegany State Park

5.1.4 Local Officials, Groups, Organizations, and Individuals

County Officials

Warren County Commissioners
McKean County Commissioners
Elk County Commissioners
Forest County Commissioners

Township Officials

Barnett Township	Glade Township	Monroe Township
Benezette Township	Green Township	Perry Township
Bradford Township	Hamilton Township	Piney Township
Brokenstraw Township	Hamlin Township	Pleasant Township
Cherry Grove Township	Harmony Township	President Township
Clarion Township	Heath Township	Richland Township
Clinton Township	Hickory Township	Ridgway Township
Columbus Township	Highland Township	Rockland Township
Conewango Township	Howe Township	Sandycreek Township
Cornplanter Township	Jenks Township	Scrubgrass Township
Corydon Township	Jones Township	Sheffield Township
Cranberry Township	Lafayette Township	Spring Creek Township
Deerfield Township	Licking Township	Tionesta Township
Elk Township	Limestone Township	Triumph Township
Farmington Township	Mead Township	Victory Township
Fox Township	Millcreek Township	Watson Township
Freehold Township	Millstone Township	Wetmore Township

5.2 List of Recipients

These are the organizations and individuals that had requested a copy of Forest Plan Revision documents when this document went to print. Additional groups and individuals may have requested copies since that time and they also will receive the documents. Since our Forest Plan documents will also be available on the internet, this list includes only those who specifically requested that we send them a copy (either an electronic copy or a paper copy).

US Representatives Receiving Documents

Congressman Phil English
Congressman John E. Peterson

Pennsylvania State Senators Receiving Documents

Joseph B. Scarnati
Mary Jo White

US Senators Receiving Documents

US Senator Robert Casey
US Senator Arlen Specter

Pennsylvania House of Representatives

Martin T. Causer
Kathy L. Rapp
Dan A. Surra

Pennsylvania State Governor's Offices Receiving Documents

Governor Edward G. Rendell
Lieutenant Governor Catherine Baker Knoll

Libraries

Documents provided to local libraries for access by the public.

Bradford Area Public
Library; Bradford, PA

Friends' Memorial
Public Library; Kane,
PA

Hamlin Memorial
Library; Smethport, PA

Johnsonburg Public
Library; Johnsonburg,
PA

Marienville Area Public
Library; Marienville,
PA

Mt Jewett Memorial

Public Library; Mt
Jewett, PA

Ridgway Public
Library; Ridgway, PA

Samuel W Smith
Memorial Library; Port
Allegany, PA

Saint Marys Public
Library; Saint Marys,
PA

Sarah Steward Bovard
Memorial Library;
Tionesta, PA

Sheffield Township

Library; Sheffield, PA

Sugar Grove Free
Library; Sugar Grove,
PA

Tidioute Free Library;
Tidioute, PA

Warren Public Library;
Warren, PA

Wilcox Public Library;
Wilcox, PA

Youngsville Public
Library; Youngsville,
PA

Interested Groups, Businesses, and Organizations

Allegheny Defense Project	Hardwood Plywood & Veneer Assn	Scott's Helicopters
Allegheny Forest Alliance	Heartwood	Sierra Club, Allegheny Group
Allegheny Hardwood Utilization Group	Highland Forest Resources	Snyder Brothers Inc.
Allegheny National Forest Vacation Bureau	Hill Engineering Inc.	Tennessee Gas Pipeline
BWP Hardwoods, Inc.	Kane Hardwood	The Nature Conservancy
Dandy Forestland Services	Keith Horn, Inc.	The Wilderness Society
Donver, Inc	Kinzua-Wolf Run Marina	Transcontinental Construction Co
Edward Engineering	Marienville Rod & Gun Club	Western Pa Conservancy
Forest Co Conservation District	O.F.H.L., Inc.	Warren Times Observer
Forest Co Planning Commission	Pa Biodiversity Partnership	
	Rolfe Beagle Club	
	Russell City Store	

Interested Individuals

These individuals were identified in the Forest's database as having requested a copy of Forest Plan Revision documents:

Mr. & Mrs. Wilbur Ahn, Sr	Jim Bensman	Bob & Lorrie Brinker
George & Frances Alderson	Robert Benson	Paul Brohn
Dale E. Anderson	David Bernstein	Rusty Brown
Thomas Andreoli	James M. Berry, Sr.	Ged Bryant
J. Angove	Paul R. Bishop	Tom Buchele
Blair Anundn	Marilyn Black	Fred Buckholtz
Matt Azeles	Teresa & Norma Black	G Budenbender
Julia Badeno	Connie Boitano	Dorothy Buquo
Alex Balboa	John Gerard Boroten	Ray Burkhardt
John Noel Bartlett	Randy Botkin, MD	Christopher M. Byham
Ray & Jan Beichner	Russel & Anita Boyce	Thomas Byrnes
Bill Belitskus	H. R. Bradley	Clare Cain

Ginny Cain	Michael J. Elonich	Delores M. Huth
Doug Caldwell	Lynne Elwinger, Sr.	Lorraine Jacobs
Doug Carlson	K Elwyn	Richard A. Jakubowski
Edward Castor	Michael W. Evans	Chet James
Francis Chiappett	Troy Firth	Robert V James
Wilbur Christie	Mark Fleischman	Tom & Shirley Jeffries
Cheryl Chwastyk	Dorothy & Sherwood Fleming	Dylan H Jenkins
Arthur Clark	Chauncey Forbush	Kirk Johnson
J. Collins	Ernest Fuller	Terry Floyd Johnson
Bryan Conle	Johana Furman	Jerry Jordon
Richard A Conrad	Ray Gerst, Jr.	Kenneth C. Kane
Neal Constable	Robert M. Gianniny	Jon A Kapecki
Ron Cook	Ron Gilius	Thomas C. Kase
Scott J. Cope	Daniel Glotz	Cherie Keith
John S. Cubbon	Merrill Gonzales	Shawn C. Kelly
Curt Alt	Christopher Guth	Bill & Darlene Kersey
Richard E. Curtain	Jennifer Guyton	John A. Keslick, Jr.
Stephen D'Angelo	Louis & Lynda Hahn	Linda Kittner
Dr. Peter Dalby	William D. Harasym	Dave Kleber
Jim Danner	John Harman	Jim Kleissler
Joe & Jean Davis	Mary T. Harrison	Suzanne Klinger
Jim Decker	Jack Hedlund	Keith W. Klos
Michael W. Deighan	Carl Heinrich	Louis & Delores Knapp
Diane Delarme	Pamela Hepple	Bill Knight
Linda Devlin	Thomas Himpel	Edward S. Kocjancic
Dean Diehl	Connie Holden	John L Kolodziejski
Mike Dockry	Robert Hoskin	Marcia Kreider
John Doyal	Mary Hosmer	Karl Kridler
Calvin E. Dufour	Ken Howell	Denise Kroth
Ned B. Ellenberger	Steve Hummel	Elizabeth O. Krug

Dick Kubiak	Larry McGeehan	Howard J Rife
Paul & Marcia Kuhn	Timothy McGinnis	Melinda Ritter
Marion M. Kyde, PhD	Richard F McKinney II	James R Rowe
Larry Lambeth	John McKown	Megan Rulli
Jennifer Lantz	Martin Melville	Donald B. Ruppen
Richard M. Legar	Eugene Merritt	B. Sachau
Brandon Leja	Kenneth & Judith Miller	Jim Salvamoser
Lionel A. Lemery	Brian Mills	Gib and Sara Sanford
Dan Leonard	Terry L. Moore	Rob Santangelo
Dick Lepley	Billy Moriarity	Dickinson R. Sarah
Robert E Leslie	Terry Mort	Lenore K. Sauer
Nate Lewis	John & Shirley Neff	Victor Savitz
Paul Lilja	Jim Nelles	Titus Schleyer
Christopher Little	Homer G. Nevel	Bill Schneider
Michael P. Lovich	Charles Nilsson	Daniel Scott
Deborah L. Lunden	Dave O'Hara	Joann Seltzer
Ted Lutz	Nelson Ochs	Ken Shannon
Paul Lyskava	Richard Ordonez	Tom Sherman
John Mangus	Paul Pascuzzi	Jason Shuey
John Manning	Bill Paxon	John Simon
Donna Martin	Judith Payne	Jeanne Skirboll
Joseph V. Martin	PL Piccirillo	David L Smerkar
Joe & Diane Martin	Darryl Pierce	Paul A & Cynthia L Smith
Iran Martinez	Gene Polaski	Julie Smithson
Peter Massetto	Janet Putnam	Barbara Songer
Robert R. Masters	Charity L. Ratliff	Mark Spiers
Barbara Matthes	James Rauch	John & Linda Sproat
Denny Mattison	Jo Ellen Reikowski	Michael Stalter
Richard J. Mauk	Timothy P. Reim	Paul Steva
Craig L. Mayer	Stephen W. Rhoads	Todd Stitt

Robert Stoudt	Todd Vanerstrom	Ray Williams
Susan L. Stout	Donna J. Veatch	Terry Williams
David T. Swanson	Donald Vershay	Dan Winkelbauer
Ryan Talbott	Jerry P. Waite	Danielle M. Wirth
Robert H. Teeple	Rodger Waldman	Jonathan Wirth
Scott H Tepke	J. G. Walter	Mark D. Wolfe
David P Thomas	Tim Walter	Matt Wolford
Laura Lee Thomas	Dave Weihrauch	Peter J. Wray
Sue Thompson, PhD	William Wekselman	Howard Wurzbacher
Gary Thornbloom	C. Robert Wells	David G. Zavetsky
Dr. Robert B. Towsey	David J. Wess	Eric Zenne
Gary Uber	John Weyant	
Linda Underhill	Robert White	

Chapter 6

Glossary



Photo courtesy of B McGuinness, US Forest Service

6 GLOSSARY

6.1 Abbreviations and Acronyms

AA	Analysis Area	MUSY	Multiple-Use and Sustained-Yield Act
AASHTO	American Association of State Highway and Transportation Officials	NCT	North Country Trail
ADA	Americans with Disabilities Act	NEPA	National Environmental Policy Act
AMS	Analysis of the Management Situation	NF	National Forest
ANF	Allegheny National Forest	NFMA	National Forest Management Act
APE	Area of Potential Effects	NFS	National Forest System
ASQ	Allowable Sale Quantity	NNIS	Non-native Invasive Species
ATV	All-Terrain Vehicle	NOI	Notice of Intent
BA	Biological Assessment	NRA	National Recreation Area
BE	Biological Evaluation	NRHP	National Register of Historic Places
BEIG	Built Environment Image Guide	OGM	Oil, Gas and Minerals
BMP	Best Management Practices	OHM	Off-Highway Motorcycle
CE	Cumulative Effects	PAOT	People At One Time
CERCLA	Comprehensive Environmental Response Compensation, and Liability Act	PILT	Payment in Lieu of Taxes
CAP	Cherry, Ash and Poplar	PNV	Present Net Value
CEQ	Council on Environmental Quality	RAP	Roads Analysis Process
CFR	Code of Federal Regulations	RARE	Roadless Area Review and Evaluation
CMAI	Culmination Mean Annual Increment	RD	Ranger District
DBH	Diameter at Breast Height	RFSS	Regional Forester Sensitive Species
DEIS	Draft Environmental Impact Statement	PPM	Parts Per Million
DC	Desired Condition	RM	Roaded Modified
EA	Environmental Assessment	RN	Roaded Natural
EIS	Environmental Impact Statement	RNA	Research Natural Area
ELT	Ecological Land Type	ROS	Recreation Opportunity Spectrum
EPA	Environmental Protection Agency	ROD	Record of Decision
ESA	Endangered Species Act	S&Gs	Standards and Guidelines
FEIS	Final Environmental Impact Statement	SHPO	State Historic Preservation Office
FPR	Forest Plan Revision	SIA	Special Interest Area
FR	Forest Road	SIL	Scenic Integrity Level
FS	Forest Service	SMS	Scenery Management System
FSH	Forest Service Handbook	SPM	Semi-primitive Motorized
FSM	Forest Service Manual	SPNM	Semi-primitive Non-motorized
FY	Fiscal Year	SUP	Special Use Permit
GIS	Geographic Information System	SVE	Species Viability Evaluation
GPS	Geographic Positioning System	TES	Threatened, Endangered, and Sensitive
I&E	Information and Education	TEPS	Threatened, Endangered, Proposed, and Sensitive
IDT	Interdisciplinary Team	TSI	Timber Stand Improvement
IOC	Issues, Opportunities and Concerns	TDD	Telecommunication Device for the Deaf
LAC	Limits of Acceptable Change	TTY	Teletype
LNT	Leave No Trace	USDA	United States Department of Agriculture
LRMP	Land and Resource Management Plan ("Forest Plan")	USDI	United States Department of Interior
PLRMP	Proposed LRMP	USFS	United States Forest Service
LTA	Land Type Association	USFWS	USDI Fish and Wildlife Service
MA	Management Area	USNPS	USDI National Park Service
MBF	One Thousand Board Feet	VIS	Visitor Information Services
M&E	Monitoring and Evaluation	VMS	Visual Management System
MMBF	One Million Board Feet	VQO	Visual Quality Objective
MIS	Management Indicator Species	WFU	Wildland Fire Use
		WSR	Wild and Scenic River
		ZOI	Zone of Influence

6.2 Terms

The following definitions and/or descriptions clarify terminology used in the Land and Resource Management Plan and Final Environmental Impact Statement.

[A]

ABIOTIC – Non-living. Climate is an abiotic component of ecosystems.

ACTIVITY FUELS – Fuels resulting from, or altered by, forestry practices such as timber harvest or thinning, as opposed to naturally created fuels.

ACQUISITION – Obtaining land or land interest through purchase, exchange, and donation.

ADAPTIVE MANAGEMENT – A type of natural resource management that implies decisions are made as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

ADMINISTRATIVE USE – Use of National Forest land, interests in land, or other resources, by the Forest Service, or an individual or entity authorized by the Forest Service, for the protection, administration, or management of the National Forest.

ADVANCE REGENERATION – Seedlings or sapling that develop or are present in the understory.

AERIAL DETECTION – A system for, or the act of discovering, locating, and reporting insect and/or disease damage, overall forest conditions and/or fires from aircraft.

AERIAL LOGGING – Removing logs from a timber harvest area by helicopter. Fewer roads are required, so the impact to an area is minimized.

AFFECTED ENVIRONMENT – The current state of the environment that may be affected by the plan or project.

AGE CLASS – One of the intervals into which the age range of trees is divided for classification or use. A distinct aggregation of trees originating from a single natural event or regeneration activity, or a grouping of trees, such as a 10-year age class, as used in inventory or management.

AIRSHED – A geographic area that shares the same air.

ALLEGHENY HARDWOODS – Forest type containing Black Cherry, Yellow Poplar, White Ash, red maple and other species.

ALL-TERRAIN VEHICLE (ATV) – Any motorized, off-highway vehicle 50 inches or less in width, having a dry weight of 600 pounds or less that travels on three or more low-pressure tires with a seat designed to be straddled by the operator. Low-pressure tires are 6 inches or more in width and designed for use on wheel rim diameters of 12 inches or less, utilizing an operating pressure of 10 pounds per square inch (psi) or less as recommended by the vehicle manufacturer.

ALLOWABLE SALE QUANTITY (ASQ) – The amount of timber that may be sold within a certain time period from an area of suitable land. See discussion in LRMP for more detail.

ALTERNATIVE – Alternatives provide options for meeting the purpose and need of a Plan revision process by emphasizing reasonable ways to resolve management issues as though each alternative were a separate Forest Plan. While all alternatives provide a wide range of multiple uses, goods and services, they respond to the issues needing change in different ways and describe a different desired future condition.

AMERICANS WITH DISABILITIES ACT (ADA) – Law requiring that persons with disabilities not be denied access to the programs provided to all other people by state and local governments, public accommodations, public transportation, and commercial establishments, solely because of their disability.

ANALYSIS AREA – The smallest unit of land recognized in the analysis process or in the spectrum model. Each acre of a given analysis area has similar productivity, response to treatment, and cost of treatment. Analysis areas divide the Forest into units which help us analyze the planning problems.

ANALYSIS OF THE MANAGEMENT SITUATION (AMS) – Using Resource Assessments and the existing Forest Plan as background, the AMS determines the ability of the area covered by the Forest Plan to supply goods and services in response to societal demands. The AMS evaluates the need to change the current plan.

ANNUAL MAINTENANCE – Work performed to maintain serviceability or repair failures during the year in which they occur. Includes preventive and/or cyclic maintenance performed in the year in which it is scheduled to occur. Unscheduled or catastrophic failures of components or assets

may also need to be repaired as a part of annual maintenance.

APPROPRIATE MANAGEMENT RESPONSE – Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

AQUATIC – Pertaining to standing and running water in streams, rivers, lakes and reservoirs.

ARTIFACT – An object made or modified by humans having cultural or historic value.

ARTIFICIAL REGENERATION – A group or stand of young trees created by direct seeding or by planting seedlings or cuttings.

ASPECT – The direction a slope faces. A hillside facing east has an eastern aspect.

ASSESSMENT (Resource Assessment) – A compilation of background material on the status of a particular resource area, on a local, regional, or national scale. A Resource Assessment describes the present condition of a particular resource and speculates on the future condition of the resource based on current and expected trends. Assessments address management problems, new policy and direction, monitoring results, and the existing condition of the resource on the forest.

[B]

BACKGROUND – A term used in the management of visual resources or scenery. It refers to the visible terrain located 3 miles to infinity from the viewer (4 miles to the viewer in flat landscapes).

BASAL AREA – The cross-section area of a tree stem including bark, in square feet, and commonly measured at breast height (4.5 feet above ground). This parameter is often used in silvicultural equations and/or models for determining growth and yield of forest stands.

BASE SALE SCHEDULE – A schedule in which the planned sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade of the planning period and this planned sale and harvest for any decade is not larger than the long-term sustained-yield capacity. (This definition expresses the principle of non-declining flow.)

BASKING AREAS – Exposed areas, i.e. sunny areas where cold-blooded amphibians can warm themselves.

BENCHMARKS – (benefits, costs, and values) Benchmarks define the maximum and minimum levels of

output. These limits take into account land capability, projected resource demands, and cost efficiency.

BENEFIT – Inclusive term used to quantify the results of a proposed activity, project, or program; expressed in monetary or non-monetary terms.

BEST MANAGEMENT PRACTICES (BMPs) – A practice or combination of practices that is determined by a State (or designated areawide planning agency) to be the most effective, practicable (including technological, economical and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

BIOLOGICAL CONTROL – The use of natural means to control unwanted pests. Examples include introduced or naturally occurring predators such as wasps or hormones that inhibit the reproduction of pests. Biological controls can sometimes be alternatives to mechanical or chemical means.

BIOLOGICAL DIVERSITY (biodiversity) – The variety of life forms and processes within an area. Included in the consideration of diversity are genetic variation, number and distribution of species, and the ways in which the variety of biologic communities interact and function.

BIOLOGICAL EVALUATION/ASSESSMENT - (Threatened, Endangered, Proposed, and Sensitive Species) – A technical report prepared by the Forest Service that uses a variety of tools, including review of existing literature and data, field survey, and data gathering and analysis, to determine the presence of, and effects of activities on, threatened, endangered, proposed, and sensitive species (FSM 2670).

BIOLOGICAL POTENTIAL – The maximum production of a selected organism that can be obtained under optimum management.

BIOMASS – The total weight of all living organisms in a biological community.

BIOME – The complex of living communities maintained by the climate of a region and characterized by a distinctive type of vegetation. Examples of biomes in North America include the tundra, desert, prairie, and the eastern hardwood forest.

BIOTIC – Living; for example, green plants and soil microorganisms are biotic components of ecosystems.

BOARD FOOT – A measurement term for lumber or timber. It is the amount of wood contained in an

unfinished board 1 inch thick, 12 inches long, and 12 inches wide. Often used variations are MBF (thousand board feet) and MMBF (million board feet).

BROADCAST BURN – A prescribed fire that burns a designated area. These controlled fires can reduce wildfire hazards, improve forage for wildlife and livestock, or encourage successful regeneration of trees.

BROWSE – Twigs, leaves, and young shoots of trees and shrubs that animals eat.

BUFFER – A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. For example buffers may be set aside next to wildlife habitat to reduce abrupt change to the habitat and along aquatic areas to minimize impacts.

BUILT ENVIRONMENT IMAGE GUIDE (BEIG)– The *built environment*, as used in this guide, refers to the administrative and recreation buildings, landscape structures, site furnishings, structures on roads and trails, and signs installed or operated by the U.S. Department of Agriculture (USDA) Forest Service, its cooperators, and permittees. The guide incorporates design standards focusing on sustainability within the natural and cultural landscape while providing optimal service to customers and cooperators.

[C]

CABLE LOGGING – Logging that involves the transport of logs from stump to collection points by means of suspended steel cables.

CANOPY – The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multistoried forest.

CAPABILITY – The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity.

CAPITAL IMPROVEMENT – The construction, installation, or assembly of a new fixed asset, or the significant alteration, expansion, or extension of an existing fixed asset, to accommodate a change of purpose.

CAPITAL INVESTMENT – An input that increases the stock of natural or manmade resources (assets) needed to maintain or increase the flow of outputs in the future. Benefits resulting from capital investments are normally recouped in excess of one year.

CARRYING CAPACITY – the maximum number of animals or people that a habitat can sustain while maintaining the ecosystem in a healthy, vigorous condition.

CAVITY – A hole in a tree often used by wildlife species, usually birds, for nesting, roosting, and reproduction.

CHEMICAL CONTROL – The use of pesticides and herbicides to control pests and undesirable plant species.

CLEANING – 1) An intermediate, release treatment made in an age class not past the sapling stage to free the favored trees from less desirable individuals of the same age class that overtop them or are likely to do so. 2) A release treatment designed to eradicate individual trees infected with diseases, such as dwarf mistletoe.

CLEARCUT – 1) A stand in which essentially all trees have been removed in one operation to produce an even-aged stand. Depending on management objectives, a clearcut may or may not have reserve trees left to attain goals other than regeneration. 2) A regeneration or harvest method that removes essentially all trees in a stand.

CLEARCUTTING REGENERATION METHOD – The cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class. Regeneration can be from natural seeding, direct seeding, planted seedlings, coppice, or advance reproduction. The management unit or stand in which regeneration, growth, and yield are regulated consists of the individual clearcut stand.

CLEARCUTTING REGENERATION METHOD WITH RESERVES – A clearcutting regeneration method in which varying numbers of reserve trees are retained to achieve goals other than regeneration. This harvest produces a two-aged stand in which varying numbers of reserve trees are not harvested.

COARSE FILTER MANAGEMENT –

Land management that attempts to address the needs of a majority of native species through management of natural landscapes and ecological communities (see fine filter management).

COHORT – A population of plants or animals having approximately the same age.

COLLECTOR ROADS – These roads serve small land areas and are usually connected to a Forest System Road, a county road, or a state highway.

COMMERCIAL FOREST LAND – Forest land that has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service, and is producing, or is capable of producing, crops of industrial wood without irreversible damage to soils, productivity, or watershed conditions, and with reasonable assurance that adequate restocking can be attained within five years after final harvesting. These lands are also appropriate for timber production.

COMMERCIAL THINNING – Thinning operation where the material cut can be sold on the market as opposed to a precommercial thinning.

COMMERCIAL USE (SPECIAL USES) – Any use or activity on National Forest System land where (a) an entry or participation fee is charged, or (b) the primary purpose is the sale of a good or service, and in either case, regardless of whether the use or activity is intended to produce a profit (36 CFR 251.51).

COMMON VARIETY MINERALS – See Mineral Material, Common Variety.

COMMUNITY (Natural Community) – An interacting assemblage of organisms, their physical environment, and the natural processes that affect them.

COMMUNICATION SITE – A developed area with a structure sufficient for placement of antennas for the transmission or reception of electronic information at the proper height.

COMPOSITION – The types of organisms and environmental features present in a particular area.

CONCERN LEVEL – A measure of the degree of public importance placed on landscapes viewed from travelways and use areas. Concern levels are divided into three categories: 1, 2, and 3.

CONCESSION PERMIT – A permit which authorizes private individuals or corporations to operate FS-owned facilities as a commercial business.

CONCOMITANT – Events that are coincident in time and so clearly related that one probably is a direct result of the other.

CONFINEMENT – The strategy employed in appropriate management responses where a fire perimeter is managed by a combination of direct and indirect actions and use of natural topographic features, fuel, and weather factors.

CONGRESSIONALLY DESIGNATED WILDERNESS – *see* Wilderness

CONIFER – A tree that produces cones, such as a pine, spruce, or fir tree.

CONNECTIVITY (of habitats) – A condition in which the spatial arrangement of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation.

CONNECTOR TRAILS – Trails that provide linkages between other trails designated for the same use or to communities that may provide services.

CONSTRAINT – A limit placed on levels of management activities that could be produced or incurred in a given time period.

CONSUMPTIVE USE – Resource use that reduces the supply, such as logging and mining.

CONTOUR – A line drawn on a map connecting points of the same elevation.

CONTROLLED - The completion of control line around a fire, any spot fires therefrom, and any interior islands to be saved; burned out any unburned area adjacent to the fire side of the control lines; and cool down all hot spots that are immediate threats to the control line, until the lines can reasonably be expected to hold under the foreseeable conditions.

CONVERTIBLE PRODUCTS – Timber products that can be measured in cubic feet of solid wood (FSH 2409.18, sec. 87).

CORD – A unit of gross volume measurement for stacking round or split wood. A standard cord is 4' by 4' by 8' or 128 cubic feet. A standard cord may contain 60-100 cubic feet of solid wood depending on the size of the pieces and the compactness of the stacks.

CORRIDOR (Ecological Landscape) – A landscape feature that allows animal movement between two patches of habitat or between habitat and geographically discrete resources.

COST COEFFICIENTS – Values which relate a management activity to a particular dollar cost in a specified period of time.

COST EFFICIENCY – The usefulness of specified inputs (cost) to produce specified outputs (benefits). In measuring cost efficiency, some outputs (such as environmental, economic or social impacts) are not assigned monetary values but are achieved at specified levels in a least cost manner.

COVER – Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to escape from predators, rest, and/or feed.

COVER TYPE (forest cover type) – A descriptive classification of forestland based on existing tree species in a given land area.

CREATED OPENING – An opening in the forest cover created by the application of even-aged silvicultural practices.

CRITICAL HABITAT – Areas designated for the survival and recovery of species listed as threatened or endangered under the federal Endangered Species Act.

CROWN HEIGHT – The distance from the ground to the base of the crown of a tree.

CULMINATION MEAN ANNUAL INCREMENT (CMAI) – The point in the growth of a tree where mean annual increment (total tree volume at any point in time divided by total age) is at a maximum. This “culmination point” for mean annual growth is regarded as the ideal harvesting or rotation age in terms of most efficient volume production.

CULTURAL RESOURCE – *see* Heritage Resource

CUMULATIVE EFFECTS – Effects on the environment that result from separate, individual actions and that, collectively, become significant over time.

[D]

DECISION CRITERIA – The information used to evaluate alternatives to a proposed action on National Forest land. Decision criteria are designed to help a decision maker identify a preferred choice from the array of alternatives.

DECOMMISSION – Demolition, dismantling, removal, obliteration and/or disposal of a deteriorated or otherwise unneeded asset or component, including necessary cleanup work. This action eliminates the deferred maintenance needs for the fixed asset. Portions of an asset or component may remain if they do not cause problems or require maintenance.

DEER WINTERING AREAS (deer yards) – Land parcels that include two basic habitat components required by white-tailed deer during winter: shelter and browse.

DEFERRED MAINTENANCE – Maintenance that was not performed when it should have been or when it was scheduled and which, therefore, was put off or delayed for

a future period. When allowed to accumulate without limits or consideration of useful life, deferred maintenance leads to deterioration of performance, increased costs to repair, and decrease in asset value.

DEME – A locally interbreeding population of organisms.

DEN TREE – A live or dead tree, at least 10” dbh, containing a natural cavity in the main stem or with exfoliating bark used by wildlife for nesting, brood rearing, hibernating, roosting, daily or seasonal shelter and escape.

DEPARTURE – A schedule which deviates from the principle of non-declining flow by exhibiting a planned decrease in the timber sale and harvest schedule at any time in the future.

DESIGN CRITERIA – The standards and guidelines of the Land and Resource Management Plan.

DESIGNATED ROAD, TRAIL OR AREA – A National Forest System road, a National Forest System trail, or an area on national forest system that is designated for motor vehicle use .. on a motor vehicle use map.

DESIRED CONDITION – This describes a future condition that is the long term goal of the Plan. It is not identified for any specific time period, but for some future period. The description identifies desired ANF uses, ecological conditions and ANF infrastructure. Activities conducted during plan implementation contribute to the achievement of this desired condition.

DESIRED LANDSCAPE CHARACTER - Appearance of the landscape to be retained or created over time. This desired character recognizes that the landscape is a dynamic, constantly changing community of plants and animals.

DEVELOPED RECREATION – Recreation activities that are dependent on the presence of constructed features or facilities. Examples include camping in a campground or using a picnic area.

DEVELOPED RECREATION SITE - An area with a concentration of constructed features or facilities managed primarily for the enhancement of recreation activities. Examples include campgrounds, picnic areas, interpretive sites, and trailheads.

DEVELOPMENT SCALE – The various levels of site modification or kinds of facilities permitted at a recreation site. The five levels are described in more detail in appendix B of the LRMP.

DIAMETER AT BREAST HEIGHT (dbh) – The diameter of a tree 4 and 1/2 feet above the ground on the uphill side of the tree.

DISPERSED RECREATION – Recreation that does not occur in a developed recreation site, such as hunting, backpacking, and scenic driving.

DISTANCE ZONES - Areas of landscapes denoted by specified distances from the observer. Used as a frame of reference in which to describe landscape characteristics or human activities and described as foreground (fg), middleground (mg) or background (bg).

DISTINCTIVE – Refers to extraordinary and special landscapes. These unusual landscapes stand out from landscapes that are typical or common.

DISTURBANCE – A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

DIVERSITY – The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

DOWN WOODY DEBRIS – Trees or portions of trees that have died and fallen to the forest floor that will be at various stages of decomposition.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) – The draft version of the Environmental Impact Statement that is released to the public and other agencies for review and comment.

[E]

EARLY STRUCTURAL HABITAT – See Structural stages.

EARLY SUCCESSIONAL SPECIES – The biotic (living) community that develops immediately following the removal or destruction of forest vegetation in an area. For instance, grasses may be the first plants to grow in an area that was burned.

EASEMENT – The right of use over the property of another owner.

ECOLOGICAL LAND TYPE (ELT) – An area of land hundreds to thousands of acres in size, with a well-known succession of forest species on unique soil materials. Ecological Land Type classification is based on geomorphic history, nature of soil substrata, and potential natural vegetation.

ECOLOGY – The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

ECOREGION – An area over which the climate is sufficiently uniform to permit development of similar ecosystems on sites that have similar properties. Ecoregions contain many landscapes with different spatial patterns of ecosystems.

ECOSYSTEM – A dynamic arrangement of living organisms interacting with each other and their non-living environment. Living organisms include plants and animals. The non-living environment includes soils, landforms, weather, and disturbances.

ECOSYSTEM MANAGEMENT – An approach to the management of natural resources that strives to maintain or restore the sustainability of ecosystems and to provide present and future generations a continuous flow of multiple benefits in a manner that is harmonious with ecosystem sustainability.

ECOSYSTEM RESTORATION – The process of reestablishing, to the extent possible, the structure, function, and composition of ecosystems.

EDGE – The margin where two or more vegetation patches meet, such as a grassy opening next to a mature forest stand, or a young stand next to a mature stand.

ENDANGERED SPECIES – A plant or animal that is in danger of extinction throughout all, or a significant portion, of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

ENDEMIC PLANT/ORGANISM – A plant or animal that occurs naturally in a certain region and whose distribution is relatively limited geographically.

ENVIRONMENTAL ANALYSIS – An analysis of alternative actions and their predictable long and short-term environmental effects. Environmental analyses include physical, biological, social, and economic factors.

ENVIRONMENTAL ASSESSMENT – A concise public document that briefly provides sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or to return a finding of no significant impact, aids an agency's compliance with NEPA when no Environmental Impact Statement is necessary, or facilitates preparation of a statement when one is necessary. An EA normally includes an analysis of alternative actions and their predictable long and short-term environmental effects.

ENVIRONMENTAL IMPACT STATEMENT (EIS) – A formal document required by the National Environmental Protection Act, as detailed in section 102(2)c (40 CFR 1508.11), and filed with the Environmental Protection Agency that considers significant environmental impacts expected from implementation of a proposed major Federal action and alternatives to it. The EIS is released as a draft to other agencies and the public for comment and review.

EQUESTRIAN USE – Pertaining to horseback riding for recreational purposes.

EROSION – The wearing away of the land surface by wind, water, ice, or other geological agents.

EVEN-AGED STAND – A stand of trees composed of predominately one or two age classes.

EVEN-AGED SYSTEM – Silvicultural system that produces even aged stands.

EXCEPTIONAL VALUE WATERS – Surface waters of high quality which satisfy biological and chemical criteria as set forth by Pennsylvania Department of Environmental Protection.

EXISTING SCENIC INTEGRITY – Current state of the landscape, considering previous human alterations. State of the landscape includes naturalness or disturbance created by human activities or alteration. Integrity is stated in degrees of deviation from the existing landscape character.

EXPLORATION (MINERALS) – Establishing the location, size, grade, or reserves of a mineral or energy resource by gathering direct evidence of the resource. Direct data gathering techniques may include drilling holes or digging pits to sample or test a known suspected zone of interest.

EXTANT – Still in existence; not extinct, destroyed, or lost.

EXTIRPATE – Eradicate, or cause the extinction of, a plant or animal species on a local or regional scale.

EXTIRPATION – Eradication or extinction of a plant or animal species on a local or regional scale.

EXTRACTION – The process of mining or removing mineral deposits, oil, or gas from the earth.

[F]

FAUNA – The animal life of an area.

FEATHERING – Partial cutting of trees along an edge to create a transition in heights between areas and/or a transition in stand density between stands of different densities (FSH 559).

FELLING – Cutting down trees.

FILTER STRIP – A portion of land that provides largely undisturbed soil to separate soil-disturbing activities from streams, ponds, wetlands, and seasonal pools. The purpose of the protective strip is to protect the soil's infiltration capacity and to filter out sediment.

FINAL CUT – The removal of the last seed bearers or shelter trees after regeneration of new trees has been established in a stand being managed under the shelterwood system of silviculture.

FINE FILTER MANAGEMENT – Management that focuses on the welfare of a single species, or only a few species, rather than the broader habitat or ecosystem (see Coarse Filter Management).

FIRE CYCLE – The average time between fires in a given area.

FIRE MANAGEMENT PLAN – A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans.

FIRE REGIME – The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality.

FIRE USE – The combination of wildland fire and prescribed fire application used to meet resource objectives.

FISHERIES HABITAT – Streams, lakes, impoundments, and reservoirs that support, or have the potential to support, fish.

FLOOD PLAIN – A flat lowland area adjoining a watercourse that is made up of unconsolidated river borne sediments and is periodically flooded.

FLORA – The plant life of an area.

FORAGE – All browse and non-woody plants that are eaten by wildlife.

FORB – A broadleaf plant that has little or no woody material in it.

FOREGROUND – A term used in the management of visual resources or scenery. The part of a scene or landscape that is nearest to the viewer, generally found from the observer up to one-half mile away or one-quarter mile away in flat landscapes..

FOREST COVER TYPE – see cover type

FOREST HEALTH – A condition wherein a forest has the capacity across the landscape for renewal, for recovery from a wide range of disturbances, and for retention of its ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products, and services.

FOREST LAND – Land at least ten percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for nonforest use.

FOREST LAND, NOT APPROPRIATE – Lands not selected for timber production in the Forest plan.

FOREST LAND, NOT SUITED – Forest land that is not managed for timber production.

FOREST LAND, SUITED – Land that is to be managed for timber production on a regulated basis.

FOREST LAND, TENTATIVELY SUITED – Forest land that has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service, and is producing, or is capable of producing, crops of industrial wood without irreversible damage to soils, productivity, or watershed conditions, and with reasonable assurance that adequate restocking can be attained within five years after final harvesting.

FOREST MATRIX – The least fragmented, most continuous pattern element of a landscape; the vegetation type that is most continuous over a landscape.

FOREST PLAN – see Land and Resource Management Plan

FOREST PLAN REVISION – A formal modification of an existing Forest Plan.

FOREST ROADS AND TRAILS – Roads and trails under the jurisdiction of the Forest Service.

FOREST SUPERVISOR – The official responsible for administering National Forest lands on an administrative unit, usually one or more National Forests. The Forest Supervisor reports to the Regional Forester.

FOREST TYPE – A descriptive term used to group stands of similar character, species composition and other ecological factors.

FOREST VEGETATION SIMULATON (FVS) – A national computer model used for growth and yield projections of forest stands.

FOREST-WIDE STANDARDS AND GUIDELINES – Standards and guidelines that may apply (based on the nature of the direction) to the entire forest. For example, forestwide riparian standards apply to all riparian areas in the ANF.

FRAGMENTATION – The physical division of contiguous areas into progressively smaller patches of increasing degrees of isolation from each other.

FROST HEAVE – A land surface that is pushed up by the accumulation of ice in the underlying soil.

FUELS – Plants and woody vegetation, both living and dead, that are capable of burning.

FUELS MANAGEMENT – The treatment of fuels that would otherwise interfere with effective fire management or control. For instance, prescribed fire can reduce the amount of fuels that accumulate on the forest floor before the fuels become so heavy that a natural wildfire in the area would be explosive and impossible to control.

FUELWOOD – Wood cut into short lengths for burning.

FUNCTION – All the processes within an ecosystem through which the elements interact, such as succession, the food chain, fire, weather, and the hydrologic cycle.

[G]

GAME SPECIES – Any species of wildlife or fish that is harvested according to prescribed limits and seasons.

GEOCACHING – A sport where individuals or organizations set up caches, using Global Positioning System (GPS) coordinates, and share the locations of these caches on the Internet. GPS users can then use the location coordinates to find the caches.

GEOMORPHIC PROCESSES – Processes that change the form of the earth, such as volcanic activity, running water, and glacial action.

GEOMORPHOLOGY – The science that deals with the relief features of the earth's surface.

GEOGRAPHIC INFORMATION SYSTEMS (GIS) – GIS is both a database designed to handle geographic data as well as a set of computer operations that can be used to analyze data.

GLOBAL POSITIONING SYSTEM (GPS) – a navigational system using satellite signals to fix the location of a receiver on or above the earth's surface.

GOAL – A concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad terms and is timeless in that it has no specific date by which it is to be completed.

GOODS AND SERVICES – The various outputs, including on-site uses, produced by forest and rangeland resources (36 CFR 219.3).

GROUND FIRE – A fire burning along the forest floor.

GROUND WATER – The supply of fresh water under the earth's surface in aquifers and soils.

GROUP SELECTION REGENERATION METHOD – A method of regenerating uneven-aged stands in which trees are cut, in small groups, and new age classes are established. The groups are one-half to three acres in size, with small openings providing microenvironments suitable for shade tolerant regeneration, and the larger openings providing conditions suitable for more shade intolerant regeneration. In the group selection regeneration method, the management unit or stand in which regeneration growth and yield are regulated consists of a landscape containing an aggregation of groups.

GUIDELINE – A guideline is an expected course of action that promotes the achievement of Forest Plan desired condition, goals and objectives. A project-level analysis and a signed decision (by the responsible official) are required in order to deviate from an established guideline.

GUIDING – Providing services or assistance (such as supervision, protection, education, training, packing, touring, subsistence, interpretation, or other assistance) to individuals or groups, in their pursuit of a natural resource-based outdoor activity, for pecuniary remuneration or other gain. The term "guide" includes the holder's employees, agents, and instructors.

[H]

HABITAT – The natural environment of a plant or animal. An animal's habitat includes the total environmental conditions for food, cover and water within its home range.

HABITAT CAPABILITY – The ability of a land area or plant community to support a given plant or animal species.

HABITAT DIVERSITY – The number of different types of plant or animal species habitat within a given area.

HARD SNAG – Snags composed essentially of sound wood on the outside.

HARDWOOD – A broad-leaved flowering tree, as distinguished from a conifer. Trees belonging to the botanical group of angiospermae.

HAZARDOUS FUELS – Naturally occurring vegetation, both live and dead, that given a wildfire occurrence would present a higher than normal resistance to control. Hazardous fuels may be measured by tons per acre, fuel arrangement, and/or continuity or burning characteristics.

HEALTHY FOREST – A condition wherein a forest has the capacity, across the landscape, for renewal, for recovery from a wide range of disturbances, and for retention of ecological resiliency, while meeting current and future needs of people for desired levels of values, uses, products and services.

HERBICIDE – A chemical used to control, suppress or kill plants, or to severely interrupt their normal growth processes.

HERITAGE RESOURCE – Historic landscapes, archaeological sites, buildings, structures, features, artifacts, Native American Traditional Cultural properties, and/or related clusters of these (referred to as "districts").

HIBERNACULA – Plural form of hibernaculum.

HIBERNACULUM – A shelter, such as a cave or abandoned mine, occupied during the winter by a hibernating animal, such as an Indiana bat.

HORIZONTAL DIVERSITY – The distribution and abundance of different plant and animal communities, or plant conditions, across an area of land; the greater the numbers of communities or condition stages in a given area, the higher the degree of horizontal diversity.

HYDROLOGY – The study of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

[I]

IGNEOUS ROCK – Rocks formed when high temperature, molten mineral matter cools and solidifies.

IMMEDIATE FOREGROUND – The detailed feature landscape found within the first 300 hundred feet of the observer. This distance zone is normally more useful to project level planning than to broad scale planning.

IMPLAN® – An economic impact assessment modeling system. IMPLAN allows the user to easily build economic models to estimate the impacts of economic changes in their states, counties, or communities.

IMPLEMENTING REGULATIONS – Regulations generated by an agency to implement an Act of Congress; i.e., 36 CFR 219 contains implementing regulations for RPA and NFMA.

IMPOUNDMENTS – Structures used to collect and confine water, as in a reservoir.

IMPROVED ROAD – An improved road is any constructed or existing feature or facility created on the land for the purpose of travel by passenger vehicles (four wheeled, two wheel drive) which are legally owned and operated on Forest roads and highways, and vehicles that are greater than 50 inches in width. Said facility will have an area for vehicles to travel on and will incorporate some manner for disposal of surface runoff.

IMPROVEMENT CUTTING – An intermediate treatment made in a stand, pole-sized or larger, primarily to improve composition and quality by removing less desirable trees of any species.

INDICATOR SPECIES – A plant or animal species related to a particular kind of environment. Its presence indicates that specific habitat conditions are also present.

INDIGENOUS (species) – Any plant or animal species native to a given land or water area by natural occurrence.

INDIVIDUAL TREE SELECTION – Uneven-aged cutting method in which selected trees from specified size or age classes are removed over the entire stand area to meet a predetermined goal of size or age distribution and species composition in the remaining stand (FSM 2470).

INFRA – An integrated data management tool where Forest managers enter, manage and report information and associated financial data in an inventory of constructed features on the land (such as buildings, dams, bridges, water systems, roads, trails, developed recreation sites, range improvements, administrative sites, heritage sites, general forest areas and wilderness). The database also includes information on permits and contracts that alter Forest land.

INSECTICIDE – An agent used to control insect populations.

INTANGIBLE VALUES (INTANGIBLE OUTPUTS) – Goods, services, uses and conditions which are believed to have values to the society but which have neither market values nor assigned values.

INTEGRATED PEST MANAGEMENT (IPM) – A process for selecting strategies to regulate forest pests in which all aspects of a pest-host system are studied and weighed. The information considered in selecting appropriate strategies includes the impact of the unregulated pest population on various resources values, alternative regulatory tactics and strategies, and benefit/cost estimates for these alternative strategies. Regulatory strategies are based on sound silvicultural practices and ecology of the pest-host system and may consist of a combination of tactics such as timber stand improvement plus selective use of pesticides. A basic principle in the choice of strategy is that it be ecologically compatible or acceptable.

INTERDISCIPLINARY TEAM – A team of individuals with skills from different disciplines that focuses on the same task or project.

INTERIOR FOREST – An area of late structural or old forest that is large enough, and of an appropriate shape, to provide conditions that minimize predation, parasitism, and microclimate fluctuations associated with forest edges. These interior forest conditions provide habitat for a diversity of wildlife and plant species.

INTERMEDIATE TREATMENT – A collective term for any treatment or tending designed to enhance growth, quality, vigor, and composition of the stand after establishment or regeneration and prior to final harvest

INTERMITTENT STREAM – A stream which flows during wet portions of the year and has a defined channel and banks that transport water, sediment and organics. They dry up when the water tables drops below the stream bed.

INTERPRETATION – Communication and education that forges emotional and intellectual connections between the interests of the audience and the inherent resource meanings.

INTOLERANT SPECIES – Those plant species that do not grow well in shade.

INVASIVE SPECIES – A species that is 1) nonnative (or alien) to the ecosystem under consideration, and 2) whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

INVASIVE SPECIES, APPROACHES:

Contain – Prevent the spread of the invasive species beyond the perimeter of patches or infested areas.
Tolerate invasive species within established infestation areas, but suppress or eradicate outside those areas.

Eradicate – Totally eliminate an invasive species from the Forest or location. Eradication methods may include the following, either individually or in combination:

Suppress – Prevent reproduction throughout the target area and reduce the area coverage of the invasive species. Prevent the invasive species from dominating the area, but accept low levels.

Tolerate – Accept the continued presence of established infestations and the probable spread to ecological limits for certain invasive species. Use preventive practices to preclude new infestations.

INVASIVE SPECIES, METHODS OF CONTROL:

Biological – The deliberate introduction and establishment of natural enemies to reduce the target species' competitive or reproductive capacities. Includes, but is not limited to, insects and pathogens such as fungi. The purpose is not eradication, but to reduce densities and rate of spread to an acceptable level.

Chemical – Direct and broadcast application of approved herbicides, following EPA label requirements, USDA policy, and Forest Service policy and direction (FSM 2150, FSH 2109.11, FSH 2109.12, and FSH 2109.13).

Cultural/Land Use – Practices that discourage initial infestation of invasive species. Includes, but is not limited to, seeding, planting and retaining brush and tree canopy cover, and minimizing the extent and duration of exposed soil during management actions.

Physical/Mechanical – Hand or mechanical labor to physically remove all or any part of the plant. Includes, but is not limited to, hand digging, mowing, tilling, and burning.

INVENTORIED ROADLESS AREA – (1) Areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000 or (2) roadless areas to be evaluated and considered for wilderness in the forest planning process.

IRRETRIEVABLE – One of the categories of impacts mentioned in the National Environmental Policy Act to be included in Environmental Impact Statements. An irretrievable effect applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is irretrievably lost. The loss of timber production during that time, however, is not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

IRREVERSIBLE – A category of impacts mentioned in statements of environmental impacts that applies to non-renewable resources, such as minerals and archaeological sites. Irreversible effects can also refer to effects of actions that can be renewed only after a very long period of time, such as the loss of soil productivity.

ISSUE – A subject or question of wide-spread public discussion or interest regarding management of National Forest System land.

[K]

K-V FUNDS – In 1930 Congress passed the Knutson-Vandenberg Act (K-V Act) to authorize collection of funds for reforestation and timber stand improvement work on areas cut over by a timber sale.

[L]

LADDER FUELS – Vegetation located below the crown level of forest trees that can carry fire from the forest floor to tree crowns. Ladder fuels may be low-growing tree branches, shrubs, or smaller trees.

LAND ADJUSTMENT – Changing National Forest System land ownership through acquisition, exchange, or disposal of land or interest in land.

LAND ALLOCATION – The commitment of a given area and its resources to a particular management area.

LANDFORM – A natural feature of the surface of the land; includes such features as slopes, valleys, plateaus, and ridges.

LANDING – Any place where cut timber is assembled for further transport from the timber sale area.

LANDLINE – National Forest System boundary lines.

LANDSCAPE – An area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human influences. Landscapes are variable in size, shape, and pattern and are often used for coarse filter analysis.

LANDSCAPE CHARACTER – Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique. This includes the visual image created by the physical, biological and cultural factors of the past, present and future.

LANDSCAPE SETTING – The context and environment in which a landscape is set; a landscape backdrop.

LANDSCAPE VISIBILITY – Accessibility of the landscape to viewers, referring to one's ability to see and perceive landscapes.

LAND AND RESOURCE MANAGEMENT PLAN (LRMP) – Formal name for the Forest Plan, the LRMP is a document that guides all long-range natural resource management activities for a National Forest. For more discussion on LRMP, see introduction to the LRMP.

LAND TYPE ASSOCIATION (LTA) – Areas of common ecosystem characteristics that generally number in the thousands of acres. LTAs are defined by similarities in general topography, geomorphic processes, geology, soil and potential plant community patterns.

LATE STRUCTURAL HABITAT – See Structural Stages.

LEASABLE MINERALS – These include coal, oil, gas, phosphate, sodium, potassium, oil shale, and geothermal steam that are leased for development (FSM 2811.2).

LEAVE NO TRACE – A program supported by the non-profit Leave No Trace Center for Outdoor Ethics, in partnership with public and private land managers, to promote and inspire responsible outdoor recreation through education and research. Four federal land management agencies, including the USDA Forest Service, actively promote the Leave No Trace principles of responsible, low-impact use to build awareness, appreciation, and respect for our wildlands.

LIFE HISTORY – The sequence of changes making up the span of an organism's life.

LINEAR PROGRAMMING – A mathematical technique for determining the effects of alternative resource allocations.

LITTER (forest litter) – The freshly fallen, or only slightly decomposed, plant material on the forest floor. This layer includes foliage, bark fragments, twigs, flowers, and fruit.

LOCAL ROAD – Serves smaller land areas than collector roads. Connects to other roads or terminal facilities.

LOGGING RESIDUE (slash) – The residue left on the ground after timber cutting. It includes unutilized logs, uprooted stumps, broken branches, bark, and leaves. Certain amounts of slash provide important ecosystem roles, such as soil protection, nutrient cycling, and wildlife habitat.

LONG-TERM SUSTAINED YIELD – The highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives.

[M]

M – Thousand. Five thousand board feet of timber can be expressed as 5M board feet.

MACRO-CLIMATE – The general, large scale climate of a large area, as distinguished from the smaller scale micro climates within it.

MAINTENANCE – The act of keeping fixed assets in acceptable condition. It includes preventive maintenance, normal repairs, replacement of parts and structural components, and other activities needed to preserve a fixed asset, so that it continues to provide acceptable service and achieves its expected life. Maintenance excludes activities aimed at expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, those originally intended.

MAINTENANCE LEVEL - Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria. For more information, see discussion in Chapter 3 of the FEIS.

MANAGEMENT AREAS (MA's) – Areas of the National Forest designated in the Forest Plan as having similar desired conditions, standards and guidelines. Similar to city planning zones.

MANAGEMENT INDICATOR SPECIES (MIS) – A wildlife species whose population will indicate the health of the ecosystem in which it lives and, consequently, the effects of forest management activities to that ecosystem.

MANAGEMENT PRACTICE – A specific activity, measure, course of action, or treatment.

MANAGEMENT PRESCRIPTION – See Prescription.

MARKET VALUE (MARKET OUTPUT) – Goods, services and uses which are commonly bought and sold and which are priced or valued directly from existing markets.

MASS MOVEMENT/WASTING – The down-slope movement of large masses of earth material by the force of gravity. Also called a landslide.

MAST TREES – Species that provide nuts and fruits. These include the oak group, American beech, hop hornbeam and black cherry.

MATURE TIMBER – Trees that have attained full development, especially height, and are in full seed production.

MEAN ANNUAL INCREMENT OF GROWTH – The increase in size and volume of a stand of trees at a particular age divided by that age in years.

MECHANIZED VEHICLES – Any contrivance which travels over ground, snow, or water on wheels, tracks, skids or by floatation, and is propelled by a living power source contained, or carried on or within, the device.

METAPOPOPULATION – A group of locally interbreeding populations, or demes, each isolated in a patch of habitat. The persistence of the metapopulation is dependent on the persistence of the demes and movement of animals among demes to exchange genes.

MICRO-CLIMATE – The climate of a small site. It may differ from the macro-climate of the area due to aspect, tree cover (or the absence of tree cover), or exposure to winds.

MID STRUCTURAL HABITAT – See Structural stages.

MIDDLEGROUND – The zone between the foreground and background in a landscape. The area is located from 1/2 to 4 miles from the observer. (1/4 mile to 3 miles, in flat landscapes)

MINERAL – Inorganic material that includes sand, gravel, and stone.

MINERAL MATERIALS, COMMON VARIETY – Also referred to as Salable Minerals or Mineral Materials, include construction and landscaping materials (cinders, sand, gravel, boulders, loose rock and common clay) and minerals of similar occurrence commonly used as aggregate, rip-rap, ballast, borrow or fill.

MINERAL RIGHTS – Owning minerals beneath the surface of the ground; often it is someone other than the owner of the surface.

MINERAL SOIL – Soil that consists mainly of inorganic material, such as weathered rock, rather than organic matter.

MISSION (of the USDA Forest Service) – "To Care for the Land and Serve the People." As set forth in law, the Forest Service mission is to achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people.

MITIGATION – Actions taken to avoid, minimize, rectify, maintain or monitor the impact of a land management practice.

MONITORING AND EVALUATION – The periodic evaluation of forest management activities to determine how well objectives are met and how management practices should be adjusted. (see Adaptive Management)

MORTALITY – Trees that have died within a specified period of time. The term mortality can also refer to the rate of death of a species in a given population or community.

MOSAIC – Areas with a variety of plant communities over a landscape, such as areas with trees and areas without trees occurring over a landscape.

MOTORIZED VEHICLES – Any contrivance which travels over ground, snow, or water on wheels, tracks, skids, or by floatation and is propelled by a non-living power source contained or carried on or within the device.

MULTIPLE USE – Managing National Forest resources in a manner to best meet the needs of the American people, recognizing that not all uses can occur on all acres and that changing needs and conditions over time will change the combination and intensity of use. Productivity of the land and sustainability of ecosystems is maintained, and the interrelationships among resources and the effects of use are monitored and evaluated. Multiple-use management does not necessarily prescribe the combination of uses that will give the greatest dollar return or the greatest unit output.

[N]

NATIONAL REGISTER OF HISTORIC PLACES (NR) – Listings of historic properties (or heritage resources) that meet the criteria of significance established by the National Historic Preservation Act.

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA) – NEPA establishes a national policy to encourage productive and enjoyable harmony between humankind and the environment, to promote efforts that will prevent or eliminate damage to the environment and stimulate the health and welfare of humans, to enrich the understanding of the ecological systems and natural resources important to the nation, and to establish a Council on Environmental Quality. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public lands.

NATIONAL FOREST MANAGEMENT ACT OF 1976 (NFMA) – NFMA requires the Secretary of Agriculture to assess forest lands, develop management programs based on multiple-use and sustained yield principles, and implement a Land and Resource Management Plan for each National Forest.

NATIONAL FOREST SYSTEM ROADS – Those roads wholly or partly within, or adjacent to and serving, the National Forests, and other areas administered by the Forest Service that have been included in the Forest Transportation Atlas (36 CFR 212.1 and 261.2).

NATIONAL FOREST SYSTEM TRAILS – Those trails wholly or partly within, or adjacent to and serving, the National Forests, and other areas administered by the Forest Service that have been included in the Forest Transportation Atlas (36 CFR 212.1 and 261.2).

NATIONAL PARK SERVICE (NPS) – The agency of the US Department of the Interior responsible for the administration of National Parks, Monuments, and Historic Sites. The NPS is distinct from the USDA Forest Service both administratively and by mission.

NATIONAL RECREATION AREA – Congressionally-designated areas that have outstanding combinations of outdoor recreation, aesthetic attractions, and proximity to potential users. They may also have cultural, historical, archaeological, pastoral, wilderness, scientific, wildlife, and other values contributing to public enjoyment.

NATURAL-APPEARING LANDSCAPE CHARACTER – Landscape character that has resulted from human activities, yet appears natural. Examples include the historic converting of native forests into farmlands and pastures and reverting back to forests through reforestation activities or natural regeneration.

NATURAL BARRIER – A natural feature, such as a dense stand of trees or downfall, that will restrict animal travel.

NATURAL DISTURBANCE – *see* Disturbance

NATURAL INTEGRITY (a.k.a. ecosystem integrity) – The capability of an ecosystem to support and maintain the structure and function characteristic of its particular location.

NATURAL RANGE OF VARIATION – *see* Range of variability

NEST TREE – Tree containing large nests, built by crows, herons, or hawks, that from the ground resemble a platform of sticks and are two to three feet in diameter. These may be used by owls, which do not build nests, or they may be re-used by crows, herons, and hawks, among other species.

NET PUBLIC BENEFITS – An expression used to signify the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index. The maximization of net public benefits to be derived from management of the National Forest units is consistent with the principles of multiple-use and sustained-yield management.

NO-ACTION ALTERNATIVE – The most likely condition expected to exist in the future if management practices continue unchanged.

NON-COMMERCIAL VEGETATIVE TREATMENT – The removal or felling of trees for reasons other than timber production.

NON-CONVERTIBLE PRODUCTS – Timber products that do not have a common standard conversion to cubic feet of solid wood (FSH 2409.18).

NONDECLINING YIELD – A level of timber production planned so that the planned sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade.

NON-FOREST LAND – Lands never having or incapable of having 10 percent or more of the area occupied by forest trees or lands previously having such cover and currently developed for non-forest use.

NON-GAME – Wildlife species that are not hunted for sport.

NON-MARKET VALUE (NON-MARKET OUTPUT) – Goods, services and uses which are not commonly bought or sold in existing markets. For use in comparing alternatives they are assigned dollar values derived from willingness-to-pay analysis. See also “Intangible Values.”

NON-MOTORIZED USE – Land uses requiring or largely dependent on isolation from motor vehicles and/or roads.

NON-NATIVE INVASIVE SPECIES (NNIS) – An organism that has been purposefully or accidentally introduced outside its original geographic range, and that is able to proliferate and aggressively alter its new environment, causing harm to the economy, environment, or human health (Executive Order 13112)

NON-POINT SOURCE POLLUTION – Pollution whose source is not specific in location. The sources of the discharge are dispersed, not well defined, or constant. Rain storms and snowmelt often make this type of pollution worse. Examples include sediments from earth disturbing activities and runoff from agricultural chemicals.

NON-RECREATION SPECIAL USE PERMITS – A general definition of permitted uses of ANF land. These include agriculture, community and public information, energy generation and transmission, communications, feasibility, research, training, cultural resources, and historical classes, among other uses. By definition, recreation is excluded.

NON-RENEWABLE RESOURCE – A resource whose total quantity does not increase measurably over time, so that each use of the resource diminishes the supply.

NORTHERN HARDWOODS – Primarily sugar maple, yellow birch, and beech. May include red maple, white ash, black cherry, red spruce, and hemlock.

NOTICE OF INTENT (NOI) – A notice in the federal register of intent to prepare an environmental impact statement on a proposed action.

NOXIOUS WEED – Those plant species designated as noxious weeds by the Secretary of Agriculture or by a responsible State official. Noxious weeds generally possess one or more of the following characteristics: Aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to or not common to the United States or parts thereof. (FSM 2080)

NUTRIENT CYCLE – The circulation of chemical elements and compounds, such as carbon and nitrogen, in specific pathways from the non-living parts of ecosystems into the organic substances of the living parts of ecosystems, and then back again to the non-living parts of the ecosystem. For instance, nitrogen in wood is returned to the soil as the dead tree decays. The nitrogen again becomes available to living organisms in the soil and, upon their death, the nitrogen is available to plants growing in that soil.

[O]

OBJECTIVE – A concise, time-specific statement of measurable and planned results that respond to pre-established goals.

OFF-ROAD VEHICLE (ORV) – Any motorized vehicle designed for or capable of cross-country travel on, or immediately over, land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that such term excludes (A) any registered motorboat, (B) any fire, military, emergency, or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and (C) any vehicle whose use is expressly authorized by the respective agency head under a permit, lease, license, or contract.

OFF SITE VIEWS – A term used in management of visual resources. The view beyond foreground, includes middleground and background views.

ON-SITE VIEW – A term used in management of visual resources. *see* Foreground

OPERATIONS – Activities related to the normal performance of the functions for which a fixed asset or component is intended to be used. Includes tasks such as janitorial services, vault toilet pumping, grounds upkeep, and law enforcement patrols.

ORGANIC SOIL – Soil at least partly derived from living matter, such as decayed plant material.

OUTFITTING – Providing, through rental or livery, any saddle or pack animal, vehicle or boat, tents or camp gear, or similar supplies or equipment, for pecuniary remuneration or other gain. The term "outfitter" includes the holder's employees, agents, and instructors.

OUTSTANDING MINERAL RIGHTS – Rights owned by a party other than the surface owner at the time the surface was conveyed to the United States.

OUTSTANDINGLY REMARKABLE VALUE – A river-related value that is a unique, rare or exemplary feature that is significant at a comparative regional or national scale. This is associated with evaluation of wild and scenic rivers.

OVERMATURE TIMBER – Trees that have attained full development, particularly in height, and are declining in vigor, health, and soundness.

OVERSTORY – The upper canopy layer; the plants below comprise the understory.

OVERSTORY REMOVAL – The cutting of trees comprising an upper canopy layer in order to release advance regeneration in an understory. This is the final harvest of a shelterwood regeneration sequence.

[P]

PARENT MATERIAL – The mineral or organic matter from which the upper layers of soil are formed.

PASSERINE – A bird of the very large and diverse taxonomic order Passeriformes, sometimes referred to as perching birds or, less accurately, as songbirds. More than half of all living species of birds are passerines, including species as varied as chickadees, crows, jays, wrens, thrushes, swallows, warblers, and sparrows.

PATCH – An area of vegetation that is similar in structure and composition.

PEOPLE AT ONE TIME (PAOT) – A recreation capacity determination expressed in the number of people a recreation site, facility or area can accommodate at one time.

PERCOLATION – Downward flow or infiltration of water through the pores or spaces of rock or soil.

PERENNIAL STREAM – A stream which flows year round except during drought years and is typically maintained by groundwater flow during the dry season.

PERMANENT OPENING – An opening dominated by perennial grasses, forbs, sedges and shrubs, that has less than 16 percent stocking of trees and less than 10 percent tree cover. Vegetation in permanent openings may be periodically cut or burned to prevent vegetative succession and tree growth. Optimal size of permanent openings is one-half to ten acres.

PERSONAL USE – The use of a forest product, such as firewood, for home use and not for commercial use.

PERSONAL USE OF MINERALS – Recreational mineral activities which contribute to the personal enjoyment of mineral collecting as a leisure activity and not for the purpose of realizing personal financial gain either through the sale of the material or through an exchange for other goods or services. The exchange of mineral specimens, and/or the fabrication by the collector of functional or decorative items from the collected material, and the disposal of same, are not considered to constitute a commercial activity as long as the motive for doing so is the further enjoyment of a leisure activity and not for profit.

PEST – A plant, animal, or environmental stress which the land manager determines to be detrimental to achieving resource management objectives.

PESTICIDE – A chemical used to control pests such as insects, fungi or rodents.

PIT – An open surface excavation for extracting stone.

PLAN AMENDMENT – Changes to the text of the Forest Plan decisions contained in the forest plan.

PLAN CORRECTION – Minor changes to the plan that do not substantively affect the management direction or create additional environmental consequences. These include elements of the plan that are not identified as plan decisions, corrections and updates to data or maps, changes in projections of activities, and minor text changes.

PLANNING AREA – The area of National Forest land covered by a Regional Guide or Forest Plan.

PLANNING PERIOD – The time frame for which goods, services, and effects were projected in the development of the Forest Plan.

PLANTATION – A forest crop or stand raised artificially, either by seeding or planting of young trees.

POINT SOURCE POLLUTION – Pollution traceable to a discharge of pollutants from a discernable, confined, and discrete conveyance, such as a discharge from a sewage treatment plant.

POLE TIMBER – Trees at least 5 inches in diameter, but smaller than the minimum size for sawtimber.

PRE-COMMERCIAL THINNING – Removing or felling some of the trees from a stand that are too small to be sold for lumber or house logs, so the remaining trees will grow faster.

PREDATOR – An animal that lives by preying on other animals. Predators are at or near the tops of food chains.

PRE-EXISTING USE – Land use that may not conform to current direction but existed prior to the establishment of that direction.

PREFERRED ALTERNATIVE – Chosen from among the alternatives developed in the DEIS to address the range of solutions to the Forest's management problems.

PREPARATORY CUT – An optional type of cut that enhances conditions for seed production and establishment applied under the shelterwood regeneration method.

PRESCRIBED BURNING – Application of prescribed fire.

PRESCRIBED FIRE – Any fire ignited by management actions to meet specific objectives.

PRESCRIPTION – Management practices selected to accomplish specific land and resource management objectives.

PRESENT NET VALUE (PNV) [a.k.a Net Present Value (NPV) or present net worth] – The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area.

PROCLAMATION BOUNDARY – National Forest boundary as proclaimed by the President of the United States.

PROTECTED WATER USE – Pennsylvania Department of Environmental Protection (DEP) defines which water uses shall be protected and the level of water quality criteria for the identified body of water based on their potential and existing use. Protected water uses on the ANF include cold water fisheries (CWF), high quality-cold water fisheries (HQ-CWF), exceptional value waters (EV) and warm water fisheries (WWF).

PUBLIC LAND – Land for which title and control rests with a federal, state, regional, county, or municipal government.

PUBLIC INVOLVEMENT – The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision making.

PULPWOOD – Wood suitable for manufacturing into wood pulp for composite and/or paper products.

[R]

RANGE OF VARIABILITY (a.k.a. natural range of variation or historic range of variability) –

The variability in composition, structure, and dynamics of ecosystems before EuroAmerican influence, including the variation of physical and biological conditions within an area due to climatic fluctuations and disturbances of wind, fire and flooding.

RANGER DISTRICT – The administrative subunit of a National Forest that is supervised by a District Ranger who reports directly to the Forest Supervisor.

RAPTOR – A bird of prey, such as an eagle or hawk.

RECHARGE – The addition of water to ground water by natural or artificial processes.

RECORD OF DECISION (ROD) – An official document in which a deciding official states the alternative that will be implemented from a prepared Environmental Impact Statement.

RECREATION EVENTS SPECIAL USE PERMITS – A special use designation within the Recreation Special Use category. Recreation events include organized events of a temporary nature, such as animal, vehicle, or boat races; fishing contests; rodeos; adventure games; and fairs.

RECREATION OPPORTUNITY SPECTRUM (ROS) – A formal Forest Service classification system designed to delineate, define, and integrate outdoor recreation opportunities in land and resource management planning. ROS classes are used to describe all recreation opportunity settings, from natural, undisturbed, and undeveloped to heavily used, modified and developed. ROS designations attempt to describe the kind of recreation experience one may expect to have in a given part of the National Forest. The ROS classes are discussed in detail in Chapter 3 of the FEIS.

RECREATION RIVER – Wild and Scenic Rivers Act Usage: Classification applied to rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

RECREATION SPECIAL USE PERMITS – A class of special use permits for recreation uses that serve the public, protect public health and safety, and protect the resource. These include such categories as outfitting and guiding, group use, facility related activities, and winter recreation. Within each of these categories there could be several “designations” of special use permits (FSM 2720).

RECREATION VISITOR DAY (RVD) – Recreational use of National Forest System land which aggregates twelve hours. It may consist of one person for twelve hours, two people for six hours or any equal combination.

REFORESTATION TREATMENT – A reference to a specific reforestation activity used to establish tree seedling reproduction in a stand. Examples on the ANF include planting, direct seeding, coppice or root suckers, site preparation for natural reproduction (regeneration), herbicide application, fencing and fertilization.

REGENERATION – The renewal of a forest by either natural or artificial means. The term is also used to refer to the young trees.

REGENERATION METHOD – A cutting procedure by which a new age class is created. The major methods are clearcutting, seed-tree, shelterwood, selection, and coppice. Regeneration methods are grouped into four categories: coppice, even-aged, two-aged, and uneven-aged.

REGIONAL FORESTER – The official of the USDA Forest Service responsible for administering an entire region of the Forest Service.

REGIONAL FORESTER’S SENSITIVE SPECIES – Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: (1) Significant current or predicted downward trends in population numbers or density Or (2) Significant current or predicted downward trends in habitat capability that would reduce a species existing distribution (FSM 2670.5).

REHABILITATION – A short-term management goal used to return a landscape with existing visual impacts and deviations to a desired level of scenic quality formerly found in the landscape.

REHABILITATION (OF ASSETS) – Renovation or restoration of an existing fixed asset or any of its components in order to restore the functionality or life of the asset. Because there is no significant expansion or change of purpose for the fixed asset, the work primarily addresses deferred maintenance.

RELATIVE DENSITY – Measurement of stand density in stands which accounts for variation in tree growing space requirements for variable tree sizes and species composition. It compares the crowding in a forest stand to the crowding in a stand at the average maximum density observed in undisturbed stands of similar average tree size and species composition.

RELEASE – An intermediate treatment designed to free young trees from undesirable, usually overtopping, competing vegetation.

REMOVAL CUT – The removal of most of the last seed bearers or shelter trees after regeneration is established.

REPAIR (OF ASSETS) – Work to restore a damaged, broken, or worn-out fixed asset, component, or item of equipment to normal operating condition. Repairs may be done as annual maintenance or deferred maintenance activities.

REPLACEMENT (OF ASSETS) – Substitution or exchange of an existing fixed asset or component with one having essentially the same capacity and purpose.

RESEARCH NATURAL AREA (RNA) – A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention.

RESERVE TREES – Live trees, pole-sized or larger, retained in either a dispersed or aggregated manner after the regeneration period under the clearcutting with reserves, seed-tree with reserves, shelterwood removal with reserves, group selection with reserves, or coppice with reserves regeneration methods. Trees are retained for resource purposes other than regeneration.

RESERVED MINERAL RIGHTS (mineral reservations) – Mineral rights retained by a grantor in a deed conveying land to the United States.

RESIDUAL STAND – The trees remaining standing after an event such as selection cutting or thinning.

RESILIENCE – The degree, manner, and pace of restoration of the structure and function of the original ecosystem after disturbance.

RESPONSIBLE OFFICIAL – The Forest Service employee who has been delegated the authority to carry out a specific planning action.

RESTORATION (of ecosystems) – see ecosystem restoration.

REVEGETATION – The re-establishment and development of a plant cover by either natural or artificial means, such as re-seeding.

RIPARIAN AREAS – Geographically delineable area with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems.

RIPARIAN CORRIDOR – This area encompasses the aquatic and riparian ecosystems. Prescriptions and treatments which occur in the riparian corridor would protect, manage and improve riparian resources.

RIPARIAN ECOSYSTEMS – A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

ROAD DECOMMISSIONING – Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

ROAD DENSITY - Quantity of road mileage per unit area, commonly measured as miles of road per square mile of land area.

ROAD IMPROVEMENT – Activity that results in an increase of an existing road's traffic service level, expansion of its capacity, or change in its original design function.

ROAD MAINTENANCE – The ongoing upkeep of a road necessary to regain or restore the road to the approved road management objective (FSM 7712.3).

ROAD OBLITERATION - Process of removing a road from the landscape. Obliterations are used on system and temporary roads, which are to be removed from service (decommissioned). Obliteration can include removing evidence of any access points; removing any structures from the roadbed (such as culverts, bridges, signs, guide rails, etc.); and restoring wetlands and riparian areas.

ROAD, PRIVATE – A road under private ownership authorized by a Special-Use Authorization, or a road that provides access pursuant to a reserved or private right.

ROAD, PUBLIC – Any road or street under the jurisdiction of and maintained by a public authority and open to public travel (23 U.S.C. 101(a)).

ROAD, TEMPORARY – Road authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be part of the forest transportation system and not necessary for long-term resource management.

ROAD UNCLASSIFIED – Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail. Includes those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1). This term has been replaced with unauthorized road.

ROADLESS AREA - A National Forest-system area that has been inventoried by the Forest Service for possible inclusion in the wilderness preservation system.

ROADLESS AREA REVIEW AND EVALUATION II (RARE II) - A national inventory of roadless and undeveloped areas within the National Forests and Grasslands that was completed in 1979.

ROTATION – The number of years required to establish and grow timber crops to a specified condition of maturity.

ROUNDWOOD – Pulpwood and fuelwood prepared in the round state.

RUN-OFF – That part of precipitation, as well as any other flow contributions, that appears in surface water, either perennially or intermittently.

[S]

SALVAGE CUTTING – The removal of trees to salvage economic value and/or improve stand health by stopping or reducing actual or anticipated spread of insects, disease and/or decline/mortality due to other factors (e.g. site nutrients, natural disturbances)

SANITATION CUTTING – Intermediate cutting made to remove dead, damaged, or susceptible trees to prevent the spread of pests or pathogens (FSM 2470).

SAPLING – As used in vegetation surveys, a size class definition: trees 1.0 to 4.9 inches at DBH.

SAWTIMBER – Trees that are 11 inches in diameter at breast height or larger that can be made into lumber.

SCALE – In ecosystem management, it refers to the degree of resolution at which ecosystems are observed and measured.

SCENERY MANAGEMENT SYSTEM (SMS) – SMS is a tool for integrating the benefits, values, desires, and preferences regarding aesthetics and scenery for all levels of management planning.

SCENIC ATTRACTIVENESS – The scenic importance of a landscape based on perceptions of the intrinsic beauty of landform, rockform, and vegetative pattern. This inventory is based on the premise that landscapes with the greatest variety or diversity have the greatest potential for scenic value. Scenery is classified as the following:

- A - Distinctive
- B - Typical or Common
- C - Undistinguished

SCENIC CLASS – A measurement of the relative importance or value of areas having similar inventoried characteristics of scenic attractiveness and landscape visibility. Scenic classes are mapped by combining the three classes of scenic attractiveness with the distance zones, and concern levels of landscape visibility.

SCENIC INTEGRITY LEVEL (SIL) – The state of naturalness or disturbance created by human activities or alteration. SIL is used to inventory the existing condition and to describe objectives during alternative development. See Chapter 3 in the FEIS for details.

SCENIC RIVER – Wild and Scenic Rivers Act Usage: Classification applied to rivers, or sections of rivers, that are free of impoundments; where shorelines or watersheds are still largely primitive and shorelines are largely undeveloped, but accessible at places by a road.

SCOPING – The ongoing process to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process. It may involve public meetings, telephone conversations, or letters.

SECOND-GROWTH FOREST – An area of forest that has established after some kind of human intervention that has removed some or all of the previous forested area.

SEED CUT – A type of cut that removes trees except those needed for regeneration and reserve trees. Prepares the seed bed and creates a new age class in an even-aged or two-aged stand under the seed-tree or shelterwood regeneration method. If reserve trees are retained, it is under a two-aged method of seed tree or shelterwood regeneration methods.

SEED-TREE REGENERATION METHOD WITH RESERVES – A seed-tree regeneration method in which some or all of the seed trees are retained after regeneration has become established to attain goals other than regeneration. This method creates an even-aged stand or a two-aged stand depending on management goals. Reserve trees may also include those trees that are not expected to provide seed for desirable regeneration.

SEED-TREE REMOVAL CUT – A final removal cut that releases established regeneration from competition with seed trees after they are no longer needed for seed under the seed-tree regeneration method. Reserve trees are retained during the removal cut if it is a sequence of the seed-tree with reserves regeneration method.

SEED TREE REMOVAL CUT WITH RESERVES – Under the two-aged method, seed tree regeneration method, the final removal of some of the remaining crop trees (seed trees) after regeneration is established. Some seed trees are retained to attain goals other than regeneration.

SEEDLING – As used in vegetation surveys, a size class definition: trees less than one inch at DBH.

SEEP – broad, shallow, slow-moving flow that occurs where groundwater emerges on strongly sloping to steep side slopes and low slope colluvial landforms. Seeps provide year round habitat for a variety of wildlife species, including amphibians and invertebrates.

SENSITIVE SPECIES – See Regional Forester Sensitive Species

SERIAL – Any stage of the sequence of changes in plant and animal communities on a site over time (see Succession).

SETTING – (See Landscape Setting)

SHADE TOLERANT SPECIES – Term used to describe plants that grow and develop in the shade (ex. sugar maple or hemlock).

SHADE INTOLERANT SPECIES – Term used to describe plants that can develop only in relatively open conditions (ex. aspen or birch).

SHELTERWOOD REGENERATION METHOD – A method of regenerating an even-aged stand in which the new age class develops beneath the moderated micro-environment provided by the residual trees. When the shelterwood regeneration method is employed, the sequence of treatments can include three distinct types of cuttings: 1) an optional preparatory cut to enhance conditions for seed production; 2) a shelterwood seed cut (establishment cut) to establish a moderated micro-environment, prepare the seed bed, and create a new age class, and 3) a shelterwood removal cut to release established regeneration from competition with the overwood. Cutting may be done uniformly throughout the stand (uniform shelterwood), in groups or patches (group shelterwood), or in strips (strip shelterwood).

SHELTERWOOD REMOVAL CUT – A final removal cut that releases established regeneration from competition with shelter trees after they are no longer needed for shelter under the shelterwood regeneration method.

SHELTERWOOD WITH RESERVES REGENERATION METHOD – A regeneration method in which some or all of the shelter trees are retained to attain goals other than regeneration. This method creates an even-aged stand or a two-aged stand if sufficient trees are reserved.

SHELTERWOOD REMOVAL CUT WITH RESERVES – A final removal cut that releases established regeneration from competition with shelter trees after they are no longer needed for shelter under the shelterwood with reserves regeneration method. Reserve trees are retained during the final removal cut if it is a sequence of the shelterwood with reserves regeneration method.

SHRUB OPENING – An area managed for wildlife that is dominated by short, woody vegetation and may include small patches of grassy openings and clumps of trees.

SILVICULTURAL SYSTEM – Entire process by which forest stands are tended, harvested, and replaced. It includes all cultural practices performed during the life of the stand, such as regeneration cutting, fertilization and thinning.

SILVICULTURE – The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

SILVICULTURE PRESCRIPTION – A document written or approved by a certified silviculturist that describes management activities needed to implement silvicultural treatment or treatment sequence. It also describes the desired future vegetation conditions in measurable terms (FSM 2478.03).

SINGLE TREE SELECTION – See Individual Tree Selection.

SITE PREPARATION – The removal of competition (including woody slash) and conditioning of the soil to enhance the survival and growth of seedlings or to enhance the germination of seed.

SITE SPECIFIC PLAN AMENDMENT – Plan amendments that allow a specific project or activity to deviate from plan direction. These amendments do not change plan language or plan decisions, except in the application to the specific project or activity.

SKID ROADS (a.k.a. tractor roads) – Skid trails constructed for the purpose of transporting cut trees to a landing. They are ordinarily constructed by ground clearing and/or excavation (FSH 2409.15).

SKID TRAILS – Trails used for the purpose of transporting cut trees to a road or landing. Skid trail use normally does not include ground excavation or clearing (FSH 2409).

SKIDDING – Hauling logs by sliding with a cable, not on wheels, from stump to a collection point.

SLASH – The residue left on the ground after timber cutting or left after a storm, fire, or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, among others.

SLUMP – A landslide where the underlying rock masses tilt back as they slide from a cliff or escarpment.

SMALL GAME – Birds and small animals normally hunted or trapped.

SNAG – Includes standing dead or partially dead trees that are at least six inches in diameter at breast height (dbh) and 20 feet tall. (see Hard Snag and Soft Snag)

SNOWMOBILE – A motor vehicle that is designed exclusively for use over snow and that runs on a track or tracks and/or a ski or skis.

SOFT SNAG – Snags with wood, especially sapwood, in an advanced stage of decay.

SOFTWOOD – A coniferous tree. Trees belonging to the botanical group gymnosperms.

SOIL COMPACTION – The reduction of soil volume. For instance, the weight of heavy equipment on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

SOIL PRODUCTIVITY – The capacity of a soil to produce vegetation. Productivity depends on adequate moisture and soil nutrients, as well as favorable climate.

SOIL QUALITY – The capacity of the soil to function within ecosystem boundaries to sustain biological productivity, maintain or enhance water and air quality, and support human health and habitation.

SOUND WOOD – Timber that is in solid, whole, good condition. Sound wood is free from damage, decay, or defects.

SPECIAL AREA (SA) – National Forest System lands that contain outstanding examples of plant and animal communities, geological features, scenic grandeur, or other special attributes. SAs are nationally designated by the Forest Service or by legislation. SAs are managed to emphasize recreational and other specific related values.

SPECIAL PLACES – Those specific locations in outdoor settings that have attractions and features that are identified as unique, different, distinctive, and extraordinary to people.

SPECIAL FOREST PRODUCTS – Products or natural resources that are not the traditional timber and fiber products. Examples include such products as floral greenery, Christmas trees and boughs, mushrooms, transplants (trees, shrubs or herbaceous plants), cones, medicinal plants, cuttings, herbs, fuelwood, tree sap, nuts, berries, lichen, fungi, decorative wood, and pitch.

SPECIAL USE AUTHORIZATION – An authorization issued to an individual or group by the USDA Forest Service for use of National Forest land for a special purpose. Examples might be a Boy Scout Jamboree, a water system serving private land, or a mountain bike race. Authorizations can be in the form of permits, easements, or leases.

SPECIES VIABILITY EVALUATION (SVE) – A qualitative process for gathering information on species for which viability may be a concern now or during the planning period. The process includes identifying at-risk species, compiling literature and unpublished information on those species, and using that information to develop and analyze Forest Plan revision alternatives.

SPECTRUM – A specific linear program model designed for Forest Service planning.

SPRING – Small to large defined flow from a clearly defined opening in the ground where the water table intercepts the ground surface.

STAND – A contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silviculture reporting and record-keeping.

STAND COMPOSITION – The proportion of each tree species in a stand expressed as a percentage of the total number, basal area, or volume of all tree species in the stand.

STANDARD – A required course of action, or level of attainment, that promotes the achievement of forest plan desired condition, goals or objectives. Standards found in a forest plan impose limits on natural resource management activities, generally for environmental protection. Deviation from a standard requires a plan amendment.

STATE HISTORIC PRESERVATION OFFICE(R) (SHPO) – The National Historic Preservation Act establishes an oversight role for this office/position vis a vis federal agencies operating within the states. Thus, the SHPO must concur with federal agency decisions which have the potential to affect NR-eligible properties (a.k.a. “significant Heritage Resources”).

STEWARDSHIP – Caring for the land and its resources to pass healthy ecosystems to future generations.

STOCKING LEVEL – The number of trees in an area as compared to the desirable number of trees for best results, such as maximum wood production.

STREAM - A body of water that flows within a defined channel and transports water, sediment and organics. Includes intermittent and perennial streams.

STRUCTURAL STAGES – Describe the forest vegetation conditions, primarily diameter and canopy closure of forest, of importance to wildlife. The term “structural” rather than “successional” is used to describe the vegetation conditions rather than the species composition. These stages include:

EARLY STRUCTURAL HABITAT – Seedling and sapling communities or forested stands normally less than 20 years old where the dominant canopy layer is less than 5 inches in diameter(dbh). Savannas or open areas with encroaching woody vegetation where tree cover or canopy closure is less than 40% are also considered to be early structural habitat.

MID STRUCTURAL HABITAT – Pole stands of trees where the dominant canopy layer is greater than 5 inches in diameter (dbh) and less than 20 inches in diameter (dbh) and tree cover or canopy closure is greater than 40%.

LATE STRUCTURAL HABITAT – Old forest stands where the dominant canopy layer is greater than 20 inches in diameter (dbh) and tree cover or canopy closure is greater than 40%. These also include standing dead and down tree and canopy gaps with understory and midstory development.

SUBSURFACE RIGHTS (MINERAL RIGHTS) – Ownership of or right to develop or recover the oil, gas or mineral resources under the land surface.

SUCCESSION – The sequence of changes in plant and animal communities on a site over time.

SUCCESSIONAL STAGE – *see* Seral

SUITABILITY – The appropriateness of certain resource uses or management activities to an area of land.

SUITABLE FOREST LAND – Forest land that constitutes the land base for determining the allowable sale quantity (ASQ) and is managed for timber production on a regulated basis.

SUMMER OFF-ROAD VEHICLE – All off-road vehicles except snowmobiles. (*see* Off-Road Vehicle)

SURFACE RESOURCES – Renewable resources that are on the surface of the earth, such as timber and forage, in contrast to ground water and minerals which are located beneath the surface.

SURFACE RIGHTS – Ownership of the surface of the land only; right to use the surface of the land.

SUSTAINABILITY (general) – The ability of an ecological, economic, and/or social system to maintain structure and function, and to remain resilient, in order to continue to support biological diversity (including humans and their social and economic organization) and system productivity over time.

SUSTAINABLE – The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable.

SUSTAINED YIELD – The yield that a renewable resource can produce continuously at a given intensity of management.

[T]

TAXON (TAXA) – A group of organisms at any level of the taxonomic hierarchy. The major taxa are the species and genus and the higher taxa, including the family, order, class, phylum, and kingdom. Minor taxa include subspecies and varieties.

TEMPORARY OPENING – An opening created by silvicultural treatment (e.g., clearcut or shelterwood cut), or natural event (e.g., wind throw, ice damage, pest outbreak), that is intended and allowed to be reoccupied by young trees. Temporary openings are dominated by tree seedlings and saplings less than 15 feet tall and, with time, will grow into a wooded stand.

TEMPORARY ROAD – *See* Road, Temporary.

THERMAL COVER – Cover used by animals against weather.

THINNING – An intermediate treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or to recover potential mortality. Includes crown thinning (thinning from above, high thinning), free thinning, low thinning (thinning from below), mechanical thinning (geometric thinning), and selection thinning (dominant thinning).

THIRTEEN PERCENT AREA – A term used to describe Forest Service land that drains directly into the unimpounded section of the Allegheny River between Kinzua Dam and Tionesta Dam. The area makes up 13% of the total land base managed by the ANF, and is important to aquatic species in the Allegheny River.

THREATENED SPECIES – Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

TIMBER CLASSIFICATION – The classification of forested lands into land management alternatives according to how the land relates to management of the timber resource there.

TIMBER STAND IMPROVEMENT (TSI) – Actions to improve growing conditions for trees in a stand, such as thinning, pruning, prescribed fire, or release cutting.

TRACTOR LOGGING – A logging method that uses tractors to carry or drag logs from the stump to a collection point.

TRAFFIC SERVICE LEVEL (TSL) - Describes the significant characteristics and operating conditions of a road (*FSH 7709.56, Ch 4 - Road Preconstruction Handbook, FSM 7705 - Transportation System*).

TSL A: Free flowing, mixed traffic; stable, smooth surface; provides safe service to all traffic.

TSL B: Congested during heavy traffic, slower speeds and periodic dust; accommodates any legal-size load or vehicle.

TSL C: Interrupted traffic flow, limited passing facilities, may not accommodate some vehicles. Low design speeds. Unstable surface under certain traffic or weather.

TSL D: Traffic flow is slow and may be blocked by management activities. Two-way traffic is difficult, backing may be required. Rough and irregular surface. Accommodates high clearance vehicles. Single purpose facility.

TRAIL – A designated path or travelway of varying width which is maintained for varied recreational uses.

TREATMENT AREA – The site specific location of a resource improvement activity.

TREE IMPROVEMENT – The science of dealing with the causes of resemblances and differences among trees related by descent. It considers the effects of genes and the response to environmental factors.

TROUT STREAMS

Class A Trout Stream – A Pennsylvania Fish and Boat Commission designation based on biomass criteria.

Class A is the highest level given for a trout stream.

Remote Trout Stream – An Allegheny National Forest designation of a stream that provides an experience in a remote, natural and unspoiled environment with minimal human activities.

Wilderness Trout Stream - A Pennsylvania Fish and Boat Commission designation of a stream that provides an experience in a remote, natural and unspoiled environment with minimal human activities.

TWO-AGED METHOD – Regeneration and maintenance of stands with two age classes. The resulting stand may be two-aged or tend towards an uneven-aged condition as a consequence of both an extended period of regeneration establishment and the retention of reserve trees (green trees) that may represent one or more age classes.

TWO-AGED STAND – A growing area with trees of two distinct age classes.

TWO-AGED SILVICULTURE SYSTEM – A planned sequence of treatments designed to regenerate or maintain a stand with two age classes.

TYPE CONVERSION – The conversion of the dominant vegetation in an area from forested to non-forested or from one forest type to another.

[U]

UNAUTHORIZED ROAD OR TRAIL – A road or trail that is not a forest road or trail or temporary road or trail and that is not included in the forest transportation atlas.

UNDERBURN – A burn by a surface fire that can consume ground vegetation and "ladder" fuels.

UNDERSTORY – The trees and woody shrubs growing beneath the overstory in a stand of trees.

UNEVEN-AGED METHOD – Regeneration and maintenance of stands with a multiaged structure by removing some trees in all size classes either singly or in groups or in strips.

UNEVEN-AGED STAND- A stand of trees of three or more distinct age classes, either intimately mixed or in groups.

UNEVEN-AGED SILVICULTURAL SYSTEM – A planned sequence of treatments designed to regenerate or maintain a stand with three or more age classes. Includes single-tree selection, and group selection regeneration methods.

UNREGULATED HARVEST – Tree harvest that is not part of the allowable sale quantity (ASQ).

UNSUITABLE LANDS – Forest land that is not managed for timber production.

UTILITY CORRIDOR – A linear tract of land of varying width forming a passageway through which various commodities such as oil, gas and electricity may be transported.

[V]

VARIETY CLASS – (See new term, “Scenic Attractiveness”)

VEGETATION MANAGEMENT – Activities affecting vegetation designed primarily to promote the health of forest vegetation for multiple-use purposes.

VEGETATION TYPE – A plant community with distinguishable characteristics.

VERNAL POOL – Naturally occurring or constructed small pools or depressions that are inundated for a period of time each year, primarily late fall through spring, as a result of a combination of snowmelt, precipitation and high water tables. These pools dry up for a period of time, generally during the summer and early fall. Vernal pools are free of fish and the pool basin is utilized as breeding habitat for pool-dependent amphibians and invertebrates. Vernal pools are not puddles or pools formed from ruts in roads or skid trails. Indicators during the summer or fall when they are dry include blackened or compressed leaf litter, buttressed tree trunks, and water marked tree trunks.

VERTICAL DIVERSITY – The diversity in an area that results from the complexity of the above-ground structure of the vegetation; the more tiers of vegetation and/or the more diverse the species composition, the higher the degree of vertical diversity.

VIABLE POPULATION – A population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range within the planning area (FSM 2670.5).

VIEW – A broad landscape or panorama that is kept in sight. The act of looking toward an object or a scene.

VISTA – A confined view that often focuses on a specific feature in the landscape. Unlike a view, a vista is often created and is subject to design.

VISUAL MANAGEMENT SYSTEM (VMS) – System for managing the scenic resources for forest landscapes developed in 1974 and updated to the Scenery Management System in 1995.

VISUAL QUALITY OBJECTIVE (VQO) – (See new term, “Scenic Integrity Level” and Chapter 3 of the FEIS for crosswalk of terms). A management goal for the visual resource that is based on physical and sociological characteristics of an area and on the degree of acceptable alteration of the natural appearing landscape.

[W]

WATERSHED – A geographic area in which water, sediments and dissolved materials drain to a common outlet such as a point on a larger stream or river.

WATER TABLE – The upper surface of groundwater. Below it, the soil is saturated with water.

WATER YIELD – The runoff from a watershed, including groundwater outflow.

WEEDING – A release treatment in stands not past the sapling stage that eliminates or suppresses undesirable vegetation regardless of crown position.

WETLAND – Those areas that under normal circumstances are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetation or aquatic life that requires saturated or seasonally- saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar area such as sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, springs, seeps and vernal ponds (FSM 2527.05).

WHOLE TREE REMOVAL – Felling and transporting the whole tree with its crown and sometimes even its roots for trimming and cross-cutting at a landing or mill.

WILD RIVER – Wild and Scenic Rivers Act Usage: Congressionally-designated rivers, or sections of rivers, that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

WILDERNESS - The Wilderness Act of 1964 defined a wilderness as an area of undeveloped federal land designated by Congress that has the following characteristics: (1) It generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) It has outstanding opportunities for solitude or a primitive and unconfirmed type of recreation; (3) It has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) It may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value (Wilderness Act, Sec. 2(c)).

WILDERNESS STUDY AREA – An area designated for study to determine suitability or non-suitability for preservation as wilderness.

WILDLAND FIRE – Any non-structure fire that occurs in the wildland . Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire.

WILDLAND FIRE SUPPRESSION – An appropriate management response to wildland fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.

WILDLAND FIRE USE –The application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives in pre-defined designated areas outlined in Fire Management Plans.

WILDLAND URBAN INTERFACE (WUI) – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

WILDLIFE HABITAT DIVERSITY – The distribution and abundance of different plant and animal communities and species within a specific area.

WILDLIFE OPENING – Terrestrial opening dominated by native grasses, forbs (e.g. goldenrod, ferns, meadowsweet), and/or shrubs (e.g. blackberries, raspberries, blueberries, alder) that is maintained in a non-forested condition. Only areas that are maintained primarily for wildlife benefits are considered wildlife openings.

WINDTHROW – Trees uprooted by wind.

WIND TOWERS – Includes individual wind towers for wind energy testing and monitoring facilities (small individual site-specific meteorological towers and instrumentation facilities) as well as wind energy development projects (includes wind turbine facilities, as well as access roads, electrical and transmission facilities, and other support facilities).

WOOD FIBER PRODUCTION – The growing, tending, harvesting, and regeneration of harvestable trees.

[Z]

ZONE OF INFLUENCE (ZOI) – The area influenced by Forest Service management activities.

Chapter 7

Reference List



Photo courtesy of US Forest Service

7 REFERENCE LIST

- Abrams MD, D.A. Orwig. 1996. A 300-year history of disturbance and canopy recruitment for co-occurring white pine and hemlock on the Allegheny Plateau. *Journal of Ecology* (84):353-63.
- Abrams MD. 1992. Fire and the Development of Oak Forests. *Bioscience* 42(5):346-53.
- Abrams MD. 2003. Where Has All the White Oak Gone? *Bioscience* 53(10):927-39.
- Abrams MD. 2005. Prescribing Fire in Eastern Oak Forests: Is Time Running Out? *Northern Journal of Applied Forestry* 22(3):190-6.
- Acciavatti B. 2005. Personal Communication, regarding Peach Bark Beetle, other insects.
- Adams MB, Kochenderfer JN. 1998. The Fernow Whole Watershed Acidification Study: Soil Chemistry. In: The effects of Acidic Deposition on Pennsylvania's Forests, Proceedings of the 1998 PA Acidic Deposition Conference, Vol. 1. University Park, PA: Environmental Resources Research Institute.
- Adams SA, Monsanto Company. 2000. Correspondence from Stephen A. Adams to Robert L. White, Allegheny National Forest regarding Terrestrial Field Dissipation Study of Glyphosate. St. Louis, Missouri, USA.
- Adams-Weyant B, Andrea Hille. 1996. Horse Use and Associated Impacts on the Allegheny National Forest, November 18, 1996. unpublished.
- Adovasio JM, J.D. Gunn, J. Donahue, R Stuckenrath. 1977. Meadowcroft Rockshelter 1973-74: A progress Report. *Pennsylvania Archaeologist* (45):1-93.
- Adovasio JM, R. Fryman, A. G. Quinn, D. R. Pedler. 1997. The appearance of cultigens and the early and middle woodland periods in Southwestern Pennsylvania. Presented at the annual Meeting of the Society for Pennsylvania Archaeology, Inc. Wilkes-Barre, PA.
- Aldenderfer MS, R. Dean. 1981. Cultural Resources Investigations of Compartments 45, 47, 72, 75, 137, 138, and 147, Allegheny National Forest Warren and Forest Counties, Pennsylvania Contract NO. 53-56A1-0-00402.
- Alerich CL. 2006. Personal communication consisting of 2004 FIA data summaries for (1) the Allegheny National Forest (2) Elk, Forest, McKean and Warren counties and (3) state of Pennsylvania.
- Alerich CL. 1993. Forest statistics for Pennsylvania--1978 and 1989. Resource Bulletin NE-126. USDA For. Serv. Radnor, PA.
- Alexander EB, R. Poff. 1985. Soil Disturbance and Compaction in Wildland Management. *Earth Resources Monograph* 8.
- Allegheny Defense Project. 2003. Allegheny Defense Project, Allegheny Wild! [Web Page]. Located at: <http://alleghenydefense.org/alleghenywild/#report>. Accessed 2007 Jan 11.
- Allen DC. 1999. Peach Bark Beetle and Black Cherry. The New York Forest Owner.
- Allen DC. 2005. Personal Communication regarding Peach Bark Beetle on the ANF .
- Allen TFH, T. W. Hoekstra. 1982. Hierarchy: perspectives for ecological complexity. Chicago: University of Chicago Press.
- Allen TFH, T. W. Hoekstra. 1992. Toward a unified ecology. New York: Columbia University Press.
- Allendorf FW. 2003. Introduction: Population Biology, Evolution, and Control of Invasive Species. *Conservation Biology* 17(1):24-30.
- Amato CA, Rosenthal R. 2002. Endangered species protection in New York after STATE V. SOUR MOUNTAIN REALTY, INC. N.Y.U. Environmental Law Journal 10:117-45.
- Anderson J, T. Kurvits, E. Wiken. 1992. A national ecological monitoring and assessment network: the concept. Proceedings of the National Ecological Monitoring and Research Workshop. Toronto, Ontario. State of the Environment Reporting, Occasional Paper Series No. 1.
- Anderson RM, K.M. Beer, T.F. Buckwalter, M.E. Clark, S.D. McAuley, J.I. Sams III, D.R. Williams. 2000. Water Quality in the Allegheny and Monongahela River Basins. US Geological Survey, Circular 1202. Reston, VA.

- Arney, J. D. 1985. A modeling strategy for the growth projection of managed stands. *Canadian Journal of Forest Research* 15(3):511-518.
- Arocena JM, C. Opio. 2003. Prescribed fires - induced changes in properties of sub-boreal forest soils. *Geoderma* (113):1-16.
- Askins RA. 2001. Sustaining biological diversity in early successional communities: the challenge of managing unpopular habitats. *Conservation of Woody, Early Successional Habitats and Wildlife in the Eastern United States. Wildlife Society Bulletin* (29):407-94.
- Auchmoody LR. 1982. Response of young black cherry stands to fertilization. *Can. J. For. Res.* 12:319-25.
- Bailey RG. 1980. Descriptions of the ecoregions of the United States; Miscellaneous Publication 1391. Washington DC: U.S. Department of Agriculture, Forest Service.
- Bailey SW, S. B. Horsley, R.P. Long. 2005. Thirty Years of Change in Forest Soils of the Allegheny Plateau, Pennsylvania. *Soil Science Society of America Journal* (69):681-90.
- Bailey SW, S.B. Horsley, R.P. Long, R.A. Hallett. 2004. Influence of edaphic factors on sugar maple nutrition and health on the Allegheny Plateau. *Soil Science Society of America Journal* 68:243-52.
- Baird TH. 1990. Changes in Breeding Bird Populations: between 1930 and 1985 in the Quaker Run Valley of Allegheny State Park, New York; New York State Museum Bulletin No. 477. New York State Museum.
- Baker JP, J. Van Sickle, C.J. Gagen, D.R. DeWalle, W.E. Sharpe, R.F. Carline, B.P. Baldigo, P.S. Murdoch, D.W. Bath, W.A. Kretser and others. 1996. Episodic Acidification of Small Streams in the Northeastern United States: Effects on Fish Populations. *Ecological Applications* 6(2):422-37.
- Baldigo BP, Peter S. Murdoch, Douglas A. Burns. 2005. Stream acidification and mortality of brook trout (*Salvelinus fontinalis*) in response to timber harvest in Catskill Mountain watersheds, New York, USA. *Canadian Journal of Fisheries and Aquatic Sciences* (62):1168-83.
- Balos-Miller L. 1983. Cultural Resource Evaluation of Seven sites in the Allegheny National Forest for the Collins Pine Land Exchange Volume CrRR 09-19-01-94A. Warren, Pennsylvania.
- Barclay RM, A. Kurta. 2004. Day roosting ecology of bark and cavity roosting forest bats: a synthesis. 2nd Bats and Forests Symposium and Workshop. Hot Springs, Arkansas (Abstract).
- Barrett JW, editor. 1995. *Regional Silviculture of the United States*. third ed. New York, New York, USA: John Wiley & Sons, Inc.
- Bartram J. 1751. *Observations In his Travels from Pennsylvania to Onondaga, Oswego and Lake Ontario*. London: J. Whiston and B. White.
- Beers, J. H. & Co. 1890. *A History of Potter, McKean, Elk and Cameron Counties*. Chicago, IL.
- Bellocq MI, Jones C, Dey DC, Turgeon JJ. 2005. Does the shelterwood method to regenerate oak forests affect acorn production and predation? *Forest Ecology and Management* 205:311-23.
- Bendell JF. 1974. Effects of Fire on Birds and Mammals. Quoted In: USDA-FS 2000. *The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions, Proceedings of a Special Workshop*. Nashville, TN. General Technical Report NE-288. 147 pp.
- Bent AC. 1963. *Life Histories of North American Marsh Birds*. New York, NY: Dover Publications Inc.
- Benzie JW. 1977. *Managers Handbook for Red Pine in the North Central States*; Technical Report NC-33.
- Benzie JW, McCumber JE. 1983. Red Pine. pp 89-91. In: Burns, R.M., 1983 *Silvicultural Systems for the major Forest Types of the United States*; Agriculture Handbook No. 445. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Berg TM, A. R. Geyer, W. E. Edmunds and others, Compilers. 1980. *Geologic map of Pennsylvania*. Pennsylvania Geological Survey, 4th ser., Map 1. Scale 1:250,000.

- Berger AL, Puettmann KJ, Host GE. 2004. Harvesting impacts on soil and understory vegetation: the influence of season of harvest and within-site disturbance patterns on clear-cut aspen stands in Minnesota. *Canadian Journal of Forest Research* 34:2159-68.
- Bird Conservation. Western Great Lakes Basin. Mourning Warbler [Web Page]. Located at: <http://www.uwgb.edu/birds/greatlakes/species/mowa.htm>. Accessed 2006 Dec.
- Birdsey RA. 1996. Carbon storage for major forest types and regions in the conterminous United States. In: Sampson, R. N. and D. Hair, editors. *Forests and Global Change: Forest Management Opportunities for Mitigating Carbon Emissions* (Vol. 2). Washington, DC: American Forests: 1-26.
- Bishop, Miller. 2004. Important Mammal Areas GIS Report. IMA Site Notes, GIS Data Layers and Definitions. August 1, 2004. Supplemental Report to the State Wildlife Grant Report, Important Mammal Areas Project prepared by A. V. Linzey.
- Bjorkbom JC, R.C. Larson. 1977. The Tionesta Scenic and Research Natural Areas. USDA. Forest Service General Technical Report NE-31 . Upper Darby, PA: Northeast Forest Experiment Station.
- Bjorkbom JC, Walters RS. 1986. Allegheny Hardwood Regeneration Response to Even-age Harvesting methods. Research paper NE-581. USDA Forest Service, Northeastern Forest Experiment Station.
- Black BA, Ruffner CM, Abrams MD. 2006. Native American influences on the forest composition of the Allegheny Plateau, northwest Pennsylvania. *Canadian Journal of Forest Research* (36):1266-75.
- Blye R, L. Forshey, S. Hoffman, J. Bishop. 2004. Appendix II – WCRA Final Report. IBA site notes, GIS data layers and Definitions.
- Boldurian AT, J.M. Adovasio. 1986. Who are Those Guys? An Examination of the Pre-Clovis Flintworking Complex From Meadowcroft Rockshelter and the Cross Creek Drainage. Fifty-First Annual Meeting of the Society for American Archaeology. New Orleans, Louisiana, USA.
- Bowker JM, D. B. K. English, K. H. Cordell. 1999. *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends*. Champaign, Illinois, USA: Sagamore.
- Bowker JM, Donald B. K. English, H. Ken Cordell. 1999. Projections of outdoor recreation population to 2050. In: Cordell, H. Ken; Betz, Carter ; Bowker, J.M.; and others. *Outdoor recreation in American life: a national assessment of demand and supply trends*. Champaign, IL: Sagamore Publishing. p 323-51.
- Bowker M. unpublished. Personal communication regarding Tier23 results. Athens, GA: USDA Forest Service Southern Research Station .
- Brady NC, R. R. Weil. 2002. *The Nature and Properties of Soils*. Thirteenth ed. New Jersey: Prentice Hall.
- Braun EL. 2001. *Deciduous Forests of Eastern North America*. Caldwell, New Jersey: The Blackburn Press.
- Brauning DW. 1992. *Atlas of Breeding Birds in Pennsylvania*. Pittsburgh, Pennsylvania, USA: University of Pittsburgh.
- Briggs DEG, W.D.I. Rolfe. 1983. A Giant Arthropod Trackway from the Lower Mississippian of Pennsylvania. *Journal of Paleontology* (57):377-90.
- Brinker D. 2006. personal communication. Memo related to northern goshawk territories and decline in active nests.
- Brooks RT. 2003. Abundance, distribution, trends, and ownership patterns of early-successional forests in the northeastern United States. *Forest Ecology and Management* (185):65-74.
- Brose P, D. Van Lear. 2004. Survival of Hardwood Regeneration During Prescribed Fires: The Importance of Root Development and Root Collar Location. In: *Upland oak ecology symposium: history, current conditions, and sustainability*. Edited by M.A. Spetich. Gen. Tech. Rep. SRS-73. pp 123-127. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Brose PH, D.H. Van Lear. 1998. Responses of hardwood advance regeneration to seasonal prescribed fires in oak-dominated shelterwood stands. *Canadian Journal of Forest Research* 28(3):331-9.

- Brose PH, D.H. Van Lear, R. Cooper. 1999a. Using shelterwood harvests and prescribed fire to regenerate oak stands on productive upland sites. *Forest Ecology and Management* (113):125-41.
- Brose PH, D.H. Van Lear, Keyser PD. 1999b. A Shelterwood-Burn Technique for Regenerating Productive Upland Oak Sites in the Piedmont Region. *Southern Journal of Applied Forestry* 16(3):158-63.
- Brose PH, Schuler TM, Van Lear DH, Berst J. 2001. Bringing fire back: The changing regimes of the Appalachian mixed-oak forests. *Journal of Forestry* 99(11):30-5.
- Brose PH, Miller GW, Gottschalk KW. in press. Re-Introducing Fire to the Oak Forest of Pennsylvania: Response of Striped Maple, In Proceedings 2005 National Silviculture Workshop. USDA Forest Service.
- Brose PH, Schuler TM, Ward JS. 2006. Responses of Oak and Other Hardwood Regeneration to Prescribed Fire: What We Know as of 2005 : In: *Fire in eastern oak forests: delivering science to land managers*, proceedings of a conference. GTR-NRS-P-1. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.
- Bureau of Land Management. 1996. *Partners Against Weeds – An Action Plan for the Bureau of Land Management*.
- Bureau of Topographic and Geologic Survey. 2000. Map 7 DCNR. Harrisburg, Pennsylvania, USA.
- Burford LS, M.J. Lacki, C.V. Covell J. 1999. Occurrence of moths among habitats in a mixed mesophytic forest: Implications for management of forest bats. *Forest Science* (45):323-32.
- Burns BS, D.R. Houston. 1987. Managing beech bark disease: evaluating defects and reducing losses. *Northern Journal of Applied Forestry* (4):28-33.
- Burns RM. 1983. *Silvicultural Systems for the Major Forest Types of the United States*; Agriculture Handbook No. 445. 191 pp. USDA Forest Service.
- Burns RM, Honkala BH. 1990. *Silvics of North America, Volume 1, Conifers*, Agriculture Handbook 654. Washington, DC: USDA, Forest Service.
- Burns RM, Honkala BH. 1990. *Silvics of North America, Volume 2, Hardwoods*, Agriculture Handbook 654. Washington, DC: USDA, Forest Service.
- Burns RM, Technical Compiler. 1983. *Silvicultural Systems for the Major Types of the United States*. Agriculture Handbook No. 445 . Washington, D.C.: USDA, Forest Service.
- Bush, Renate R. 1995. Northeastern TWIGS Variant of the Forest Vegetation Simulator. Forest Management Service Center.
- Calhoun AJK, P. deMaynadier P. 2004. Forestry habitat management guidelines for vernal pool wildlife. MCA Technical Paper No. 6. Bronx, New York: Metropolitan Conservation Alliance, Wildlife Conservation Society.
- Cappaert D, D.G. McCullough, T.M. Poland, N. W. Siegert. 2005. Emerald Ash Borer in North America: A Research and Regulatory Challenge. *American Entomologist* 51(3):153-65.
- Carnean, Willard H.; Hahn, Jerold T.; Jacobs, Rodney D. 1989. Site index curves for forest tree species in the eastern United States. General Technical Report NC-128. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station.
- Carnegie Museum of Natural History. 1989. *Bulletins of Carnegie Museum of Natural History*.
- Carpenter CA, Catherine Giffen, Margaret Miller-Weeks. 2003. Sustainability Assessment Highlights for the Northern United States: NA-TP-05-03. Newtown Square, PA: USDA Forest Service.
- Carter J, President. 1977. Protection of Wetlands. Executive Order 11990. May 24, 1977.
- Casler WC. 1973. *Logging Railroad Era of Lumbering in Pennsylvania, Vol. 8. Tionesta Valley*. Williamsport, Pennsylvania, USA: Lycoming Printing Company.
- Casler WC. 1975. *Tionesta Valley. Book No. 8 in the series Logging Railroad Era of Lumbering in Pennsylvania*. Pennsylvania, USA : Lycoming Printing Company.

- Casler WC. 1978. Logging Railroad Era of Lumbering in Pennsylvania, Vol. 11. Allegheny Valley Logging Railroads. Williamsport, Pennsylvania, USA: Lycoming Printing Company.
- The Center for Rural Pennsylvania, A Legislative Agency of the Pennsylvania General Assembly. unpublished. Comparative aggregations of county-level demographic profiles for the Allegheny National Forest four county region, the twelve county PA Wilds Region, PA Rural Counties and all Pennsylvania.
- Chameides WL, Ellis B. Cowling. 1995. The State of the Southern Oxidants Study: Policy-Relevant Findings in Ozone Pollution Research 1988 – 1994. Prepared on behalf of the SOS Science Team and SOS Coordinating Council.
- Chapman JP, A. Delcourt, P. A. Criddlebaugh, A. B. Shea, H. H. Delcourt. 1982. Man-Land Interaction: 10,000 Years of American Indian Impact on Native Ecosystems in the Lower Little Tennessee River Valley, Eastern Tennessee. *Southeastern Archaeology* 1(2):115-21.
- Chin A, Deven M. Rohrer, Daniel A. Marion, J. Alan Clingenpeel. 2004. Effects of All-Terrain Vehicles on Stream Dynamics. Pp. 292-296. *Within*: Guldin, James M., tech.comp.2004. Ouachita and Ozark Mountains Symposium: ecosystem management research. Gen. Tech. Rep. SRS-74. Asheville, NC: USDA Forest Service, Southern Research Station.
- Christy BH. 1939. In Brauning, D.W. 1992. Atlas of Breeding Birds in Pennsylvania. Pittsburgh, Pennsylvania, USA: University of Pittsburgh.
- Clark JS, P. D. Royall. 1995. Transformation of the Northern Hardwood Forest by Aboriginal (Iroquois) fire: Charcoal Evidence from Crawford Lake, Ontario, Canada. *The Holocene* (5):1-99.
- Cleland DT, Avers PE, McNab WH, Jensen ME, Bailey RG, King T, Russell WE. 1997. National Hierarchical Framework of Ecological Units. Published in, Boyce, M. S.; Haney, A., ed. 1997. Ecosystem Management Applications for Sustainable Forest and Wildlife Resources. New Haven, CT: Yale University Press.
- Clinton W, President. 1999. Invasive Species, Executive Order 13112, 1999. 4 pp.
- Collins BS, S.T.A. Pickett. 1982. Vegetation Composition and Relation to Environment in an Allegheny Hardwood Forest. *American Midland Naturalist* 108(1):117-23.
- Committee of Scientists. 2000. Sustaining the People's Land. Recommendations for Stewardship of the National Forests and Grasslands into the Next Century. Washington, DC, USA: USDA.
- Commonwealth of Pennsylvania. 1972. Historical and Museum Commission, 1972. (Leaflet) Deardorff, Merle H. and Harold L. Myers, Chief Complanter. Harrisburg, Pennsylvania, USA.
- Congdon CE. 1967. Allegheny Oxbow: A History of Allegany State Park and the Allegany Reserve of the Seneca Nation. Buffalo, New York, USA.
- Cooperative Emerald Ash Borer Project. 2006 Nov 6. EAB locations in Illinois, Michigan, Maryland, Ohio and southwest Ontario, Canada [Web Page]. Located at: http://www.emeraldashborer.info/files/tristate_eabpos.pdf. Accessed 2006 Dec 6.
- Cooperrider AY, Boyd HR, Stuart HR, editors. 1986. Inventory and Monitoring of Wildlife Habitat. Denver, CO: U.S. Department of Interior, Bureau of Land Management.
- Cope TM. 1936. Observations on the vertebrate ecology of some Pennsylvania virgin forests. PhD thesis. Ithaca, NY: Cornell University.
- Cordell HK, Betz C, Bowker JM, et al. 1999. Outdoor recreation in American life: a national assessment of demand and supply trends. Champaign, IL: Sagamore Publishing.
- Cordell HK, Betz CJ, Green G, Owens M. 2005. Off-Highway Vehicle Recreation in the United States, Regions and States: A National Report from the National Survey on recreation and the Environment (NSRE).
- Cordell HK, et al. 2001. American's participation in outdoor recreation: Results from the national survey on recreation and the environment 2000. Athens, GA: Southern Research Station USDA Forest Service.

- Cordell HK, et al. 2004. Outdoor Recreation for the 21st Century. A report to the Nation: The National Survey on Recreation and the environment. State College, PA: Venture Publishing, Inc.
- Costa SD, B.L. Parker, V. Gouli, M. Brownbridge, M. Skinner, S. Gouli. 2005. Insect-Killing Fungi as a Component of Hemlock Woolly Adelgid Integrated Pest Management. Proceedings of the 3rd Symposium on Hemlock Woolly Adelgid in the Eastern United States. Asheville, NC. pp 155-60.
- Cowin VL. 1985. Western Pennsylvania: Appalachian Plateau and Lake Erie Shore The Woodland Periods pp 185-193, in: A Comprehensive State Plan for the Conservation of Archaeological Resources Volume I. Pennsylvania Historical and Museum Commission. Historic Preservation Planning Series, Number 1.
- Cowin VL. 1985. The Woodland Period, in A Comprehensive State Plan for the Conservation of Archaeological Resources, Vol. II. Pennsylvania Historical & Museum Commission. Harrisburg, PA.
- Cox C. 1995. Herbicide Factsheet. Glyphosate, Part 1: Toxicology. Journal of Pesticide Reform 15(3).
- Cox C. 1995a. Herbicide Factsheet. Glyphosate, Part 2: Human Exposure and Ecological Effects. Journal of Pesticide Reform (15):14-20.
- Cox C. 1998. Herbicide Factsheet: Glyphosate (Roundup). Journal of Pesticide Reform (18):3-16.
- Cox GW. 1960. A Life History of the Mourning Warbler. Wislon Bulletin 72(1): 5-28. Quoted In: Brauning, D.W. 1992. Atlas of Breeding Birds of Pennsylvania. University of Pittsburgh Press. 483 pp.
- Crookston, Nicholas L.; Stage, Albert R. 1999. Percent canopy cover and stand structure statistics from the Forest Vegetation Simulator. Gen. Tech. Rep. RMRS-GTR-24. Ogden, UT: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 11 p.
- Crookston, Nicholas L.; Moeur, Melinda; Renner, David 2002. Users guide to the Most Similar Neighbor Imputation Program Version 2 Gen. Tech. Rep. RMRS-GTR-96. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 35 p.
- Crossley GJ. 1999. A Guide to Critical Bird Habitat in Pennsylvania. PA Important Bird Areas Program. Harrisburg, PA: PA Audubon Society.
- Crow TR, Buckley DS, Nauertz EA, Zasada JC. 2002. Effects of Management on the Composition and Structure of Northern Hardwood Forests in Upper Michigan. Forest Science 48(1):129-45.
- Cuff DJ, W.J. Young, E.K. Muller, W. Zelinsky. 1989. Atlas of Pennsylvania Temple Univ. Press.
- Curry, S., J. Kleissler, A. Clark, and Heartwood, Inc. v. U.S. Forest Service, M. P. Dombeck, R. T. Jacobs, and J. Palmer. 1997. Civil Action No. 97-1081. Memorandum and Order; October 15, 1997. Filed in the United States District Court for the Western District of Pennsylvania.
- Curtis, Robert O. 1967. Height-diameter and height-diameter-age equations for second-growth Douglas-fir. Forest Science 13(4):365-375.
- Curtis, Robert O.; DeMars, Donald J.; Herman, Francis R. 1974. Which dependent variable in site index-height-age regressions? Forest Science 20(1):74-87.
- Dahl TE. 2000. Status and trends of wetlands in the conterminous United States 1986 to 1997. USDI Fish and Wildlife Service. Washington, D.C., USA.
- Dale ME, H.C. Smith, J.N. Percy. 1995. Size of clearcut opening affects species composition, growth rate, and stand characteristics. USDA Forest Service. Research Paper NE-698. Radnor, Pennsylvania, USA : Northeastern Forest Experiment Station.
- Davidson C. 1998. Issues in measuring landscape fragmentation. Wildlife Society Bulletin (26):32-7.
- Davis MB. 1993. Old growth in the east: A Survey. Richmond, VT: Cenozoic Society Inc.
- Davis MB, J. Davis. 1996. Eastern Old-Growth Forests, Prospects for Rediscovery and Recovery. Washington D.C.: Island Press.
- de la Cr  taz A, Kelty MJ. 1999. Establishment and control of hay-scented fern: a native invasive species. Biological Invasions (1):223-36.
- de la Cr  taz A, Kelty MJ. 2006. Control of Hay-Scented Fern by Mowing. Northern Journal of Applied Forestry 23(3):149-54.

- Deardorff MH. 1999. Henry Obail -1774-1832 – “The Young Cornplanter”. Stepping Stones, a Warren County Historical Society publication(43):1756-61.
- deCalesta DS. 1994. Effect of white-tailed deer on songbirds within managed forests in Pennsylvania. *Journal of Wildlife Management* (58):711-8.
- deCalesta DS. 1998. Affidavit of David S. deCalesta Regarding Civil Action No. 97-2187 .
- deCalesta DS, L.D. Ordiway. 1999. Relative density and basal area: 3-dimensional estimators of forest canopy cover. Unpublished paper, 3/5/99. Irvine, Pennsylvania, USA : Forestry Sciences Laboratory, Northeastern Research Station, USDA Forest Service.
- deCalesta D. 1997. Personal communication regarding forest regeneration and deer densities.
- deCalesta DS. 2005. Kinzua Quality Deer Cooperative Report 2004, Deer Density and Impact Estimates, Roadside Counts, and Check Station Operation.
- deCalesta DS, Stout SL. 1997. Relative deer density and sustainability: a conceptual framework for integrating deer management with ecosystem management. *Wildlife Society Bulletin* 25(2):252-8.
- DeGraaf RM. 1987. Managing northern hardwoods for breeding birds. In: Nyland, Ralph D., editor. *Managing northern hardwoods: Proceedings of a silviculture symposium: Misc. Pub. No. 13: Syracuse, NY. 1986 June 23-25: 348-362. Syracuse, NY: State University of New York.*
- DeGraaf RM. 1991. Breeding bird assemblages in managed northern hardwood forests in New England. Quoted In: DeGraaf, R.M. and M. Yamasaki. 2001. *New England Wildlife Habitat, Natural History and Distribution. University Press of New England, 482 pp.*
- DeGraaf RM, D. D. Rudis. 1986. *New England Wildlife: Habitat, Natural History and Distribution. Northeast Forest Experiment Station. USDA Forest Service General Technical Report NE-108. Broomall, Pennsylvania.*
- DeGraaf RM, M.Y. Yamasaki, W.B. Leak, J.W. Lanier. 1992. *New England Wildlife: Management of Forested Habitats. Northeast Forest Experiment Station. General Technical Report. NE-144. Radnor, Pennsylvania, USA.*
- DeGraaf RM, M. Yamasaki. 2001. *New England Wildlife: habitat, natural history, and distribution. Hanover, New Hampshire, USA: University Press of New England.*
- DeGraaf RM, M. Yamasaki. 2003. Options for managing early-successional forest and shrubland bird habitat in the northeastern United States. *Forest Ecology and Management* (185):179-91.
- Delcourt HR. 1987. The impact of prehistoric agriculture and land occupation on natural vegetation. *TREE* (2):39-44.
- Delcourt PA, H.R. Delcourt. 1997. Report of Paleoeological Investigations Cliff Palace Pond, Jackson County, Kentucky, in the Daniel Boone National Forest. 47 p. Winchester, Kentucky, USA: USDA Forest Service, Daniel Boone National Forest.
- DeMarco LM, S. L. Stout. 1997. Communicating the story of silviculture on the Allegheny National Forest. In: *Communicating the role of silviculture in managing the National Forests: Proceedings of the National Silviculture Workshop. Warren, PA. Gen Tech Rpt. NE-238. Radnor, PA: USDA, Forest Service, NE Forest Experiment Station.*
- Demchick MC, Sharpe WE. 1999. The effect of calcium/aluminum ratio on root elongation of twenty-six Pennsylvania plants. William E. Sharpe, Joy R. Drohan, Editors. *Proceedings of the 1998 Acidic Deposition Conference on the Effects of Acidic Deposition on Pennsylvania Forests, Vol 1, University Park, PA: Environmental Resources Research Institute.*
- Department of Conservation and Natural Resources – Bureau of Forestry. 1993. *Penn’s Woods Sustaining Our Forests. Harrisburg, PA.*
- DeVivo MS. 1990. Indian use of fire and land clearance in the southern Appalachians. In: *Fire and the Environment: Ecological and Cultural Perspectives, 306-309. Southeastern Forest Experiment Station GTR-SE-69.*

- Diamond GL, Durkin PR. 1997. Effects of Surfactants on the Toxicity of Glyphosate, with Specific Reference to RODEO. SERA TR-206-1b.
- Dickson JG. 1981. Effects of forest burning on songbirds. Quoted In: USDA-FS 2000. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions, Proceedings of a Special Workshop. Nashville, TN. General Technical Report NE-288. 147 pp.
- Dionis K. 2000. Can Trees Afford to Stay Outside? Penn State Agriculture (Summer/Fall):16-27.
- Dissmeyer GE. 2000. Drinking water from forests and grasslands – A synthesis of the scientific literature. USDA Forest Service, Southern Research Station GTR-SRS-39:85-100.
- Dixon, Gary E. comp. 2002. Essential FVS: A user's guide to the Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 204p. (Last Revised: January 2006).
- Dolloff CA, Jackson R. Webster. 2000. Particulate organic contributions from forests to streams: debris isn't so bad. Ch. 7: 131-132 in Elon S. Verry, James W. Hornbeck, and C. Andrew Dolloff, editors. Riparian Management in Forests of the Continental Eastern United States. Boca Raton, FL, USA: Lewis Publishers.
- Dost FN. 1997. Environmental Consultants, Inc. Correspondence to John Palmer, Forest Supervisor, Allegheny National Forest. Stoughton, Wisconsin, USA.
- Dost FN. 1999. January 12. Draft Evaluation of Herbicide Factsheet, Glyphosate (Roundup). Journal of Pesticide Reform 18(3):3-15, 1998. Freeland, Washington, USA.
- Driscoll CT, G. B. Lawrence, A. J. Bulger, T. J. Butler, C.S. Cronan, C. Eager, K. F. Lambert, G. E. Likens, J. L. Stoddard, K. C. Weathers. 2001. Acidic deposition in the northeastern United States: sources and inputs, ecosystem effects, and management strategies. Bioscience (51):180-98.
- Driscoll CT, Kimberly M. Driscoll, Myron J. Mitchell, Dudley J. Raynal. 2003. Effects of acidic deposition on forest and aquatic ecosystems in New York State. Environmental Pollution 123:327-36
- Dunne T, L. B. Leopold. 1978. Water in Environmental Planning. New York, New York, USA: W. H. Freeman and Company.
- Durkin PR. 2003. Glyphosate - Human Health and Ecological Risk Assessment, Final Report. SERA TR-43-09-04a.
- Durner R. 2005. Personal communication regarding pulpwood.
- Dyer AF, Lindsay S. 1992. Soil Spore Banks of Temperate Ferns. American Fern Journal 92(3):89-122.
- Eastern Wilderness Areas Act. 1975. P.L.93-622.
- Edwards PJ, Kochenderfer JN, Seegrist DW. 1991. Effects of Forest Fertilization of Stream Water Chemistry in the Appalachians. Water Resource Bulletin 27(2):265-74.
- Ek, Alan R.; Birdsall, Earl T.; Spears, Rebecca J. 1984. A Simple Model for Estimating Total and Merchantable Tree Heights Research Note NC-309. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station.
- The Elk County Commissioners, The Elk County Planning Commission. 1999. The Final Elk County 1999 Update of the 1968 Comprehensive Plan.
- Elliott KJ, J.D. Knoepp. 2005. The effects of three regeneration harvest methods on plant diversity and soil characteristics in the southern Appalachians. Forest Ecology and Management 211:296-317.
- Ellsworth JW, B. C. McComb. 2003. Potential Effects of Passenger Pigeon Flocks on the Structure and Composition of Presettlement Forests of Eastern North America. Conservation Biology (17):1548-58.
- Emery MR, R.J. McLain, editors. 2001. Non-timber forest products: medicinal herbs, fungi, edible fruits and nuts, and other natural products from the forest. Binghamton, NY: Food Products Press, an imprint of the Haworth press, Inc.
- Encyclopaedia Britannica; volume 9 micropaedia, p263-264. 1987. Chicago, Illinois.
- Engelman HM, Nowak CA, Stout SL. unpublished. Survival and quality of mature and overmature black cherry (*Prunus serotina*) trees.

- Engelman HM, Nyland RD. 2006. Interference to Hardwood Regeneration in Northeastern North America: Assessing and Countering Ferns in Northern Hardwood Forests. *Northern Journal of Applied Forestry* 23(3):166-75.
- English DBK, Susan M. Kocis, Stanley J. Zarnoch, J. Ross Arnold. 2002. Forest Service National Visitor Use Monitoring Process: Research Method Documentation. General Technical Report SRS-54. Athens, GA: USDA Forest Service, Southern Research Station.
- Environmental Consultants, Inc. 1997. Final Environmental Impact Statement. Vegetation Management on Electric Utility Rights-of-Way. USDA Forest Service, Allegheny National Forest.
- Eschner AR, J. H. Patric. 1982. Debris avalanches in eastern upland forests. *Journal of Forestry* (80):343-7.
- Eyre FH, editor. 1980. Forest Cover Types of the United States and Canada; pp 1-4. Washington DC: Society of American Foresters .
- Federal Interagency Committee for the Management of Noxious and Exotic Weeds, editors. 1998. Pulling Together: A National Strategy for Management of Invasive Plants. Second ed. U.S. Government Printing Office.
- Federal Register. 2001. Department of Agriculture, Forest Service, 36 CFR Part 212, et. al. Administration of the Forest Development Transportation System; Prohibitions; Use of Motor Vehicles Off Forest Service Roads; Final Rule. Federal Register, Vol 66, No. 9, January 12, 2001, pp. 3206-3218.
- Federal Register. 2001a. Department of Agriculture, Forest Service, Forest Transportation System. Notice of final administrative policy. Federal Register, Vol 66, No. 9, January 12, 2001, pp. 3219-3241.
- Ferriss AL, Betty C Churchill, Charles H Proctor , Lois E. H. Zazove. 1962. ORRRC Study Report 19.
- Fettke CR. 1938. Bradford oil field, Pennsylvania and New York. Plate B. Bureau of Publications. Harrisburg, Pennsylvania, USA : Commonwealth of Pennsylvania.
- Fike J. 1999. Terrestrial and Palustrine Plant Communities of Pennsylvania. Harrisburg, PA: PA DCNR, Bureau of Forestry.
- Filip SM. 1978. Impact of Beech Bark Disease on Uneven-Age Management of a Northern hardwood Forest (1952-1976). General Technical Report NE-45. Broomall, PA: USDA Forest Service, Northeastern Forest Experiment Station.
- Fischer RA, O'Neil J, editors. 1997. Proceedings of session 37: Symposium. Corridors: Are they Effective in Conserving Biodiversity- Abstracts. pp 114, 172, 173. The Wildlife Society, National Conference, Snowmass CO.
- Fisher RF, D. Binkley. 2000. Ecology and Management of Forest Soils. John Wiley and Sons.
- Flaspohler DJ, S.A.Temple, R.N. Rosenfield. 2001. Effects of Forest Edges on Ovenbird Demography in a Managed Forest Landscape. *Conservation Biology* 15(1):173-83.
- Flerchinger GN, F. J. Watts. 1987. Predicting infiltration parameters for a road sediment model. *Transactions of the ASAE* (30):1700-5.
- Foltz RB, M. A. Truebe. 1995. Effect of aggregate quality on sediment production from a forest road. In Conference proceedings of the sixth international conference on low-volume roads. 1:57. Washington, DC, USA: Transportation Research Board, National Research Council.
- Forest County Conservation District and Planning Commission. 1998. Forest County Comprehensive Plan.
- Forest Stewardship Council – US. 2005. Final Appalachia (USA) Regional Forest Stewardship Standard Version 4.0.
- Forrester JA, McGee GG, Mitchell MJ. 2003. Effects of beech bark disease on aboveground biomass and species composition in a mature northern hardwood forest, 1985 to 2000. *Journal of the Torrey Botanical Society* 130:70-8.
- Frank RM, Borkbem JC. 1973. A Silvicultural Guide for Spruce-Fir in the Northeast. USDA Forest Service, Northeastern Forest Research Station.

- Franklin JF, R.T.T. Forman. 1987. Creating landscape patterns by forest cutting: Ecological consequences and principles. *Landscape Ecology* (1):5-18.
- Franklin JF, R. VanPelt. 2004. Spatial aspects of structural complexity. *Journal of Forestry* (102):22-8.
- Franklin JF. 2001. Keynote Comments. Managing Young Stands to Meet LSR and Riparian Objectives Workshop. Portland, OR.
- Franz JE, M. K. Mao, J. A. Sikorski. 1997. Glyphosate: a unique herbicide. American Chemical Society, Washington, D.C., ACS monograph, ISSN 0065-7719; 189.
- Friends of Allegheny Wilderness. 2003. A Citizens' Wilderness Proposal for Pennsylvania's Allegheny National Forest. Friends of Allegheny Wilderness.
- Funk DT, compiler. 1986. Eastern White Pine: Today and Tomorrow Symposium Proceedings; June 12-14, 1985: Durham, NH. General Technical Report WO-51. USDA Forest Service, Northeastern Research Station.
- Gannon MR, T.E. Blackburn. 2002a. Survey of bats at Allegheny National Forest with emphasis on the Indiana bat (*Myotis sodalis*). Fourth Year Report – Final Report to USDA, Forest Service, Warren, PA. Pennsylvania State University, Altoona, PA. Unpublished. 87 pp.
- Gannon MR, T.E. Blackburn. 2002b. Telemetry study of bats in Pennsylvania with emphasis on the Indiana bat (*Myotis sodalis*). Final Report to USDA, Forest Service, Warren, PA. Pennsylvania State University, Altoona, PA. Unpublished. 38 pp.
- Garber SD, J. Burger. 1995. A 20 yr. study documenting the relationship between turtle decline and human recreation. *Ecological Applications* 5(4):1151-62.
- Gbondo-Tugbawa SS, Driscoll CT. 2003. Factors controlling long-term changes in soil pools of exchangeable basic cations and stream acid neutralizing capacity in a northern hardwood forest ecosystem. *Biogeochemistry* 63:161-85.
- Godman RM, Lancaster K. 1990. *Tsuga canadensis* (L.) carr., Eastern Hemlock. In: R.M. Burns, B.H. Honkala, technical coordinators. *Silvics of North America, Volume 1, Conifers*, Agriculture Handbook 654. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Goerlich DL, R.D. Nyland. 2000. Natural Regeneration of Eastern Hemlock: A Review. In: McManus, K.A., K.S. Shields, and D.R. Souto (eds.). 1999. *Proceedings: Symposium on Sustainable Management of Hemlock Ecosystems in Eastern North America*, June 22-24, 1999. Durham, NH. General Technician Report NE-267, Newtown Square, PA: USDA Forest Service, Northeastern Research Station: 1-4.
- Goodrich LJ, M. Brittingham, J.A. Bishop, P. Barber. 2003. *Wildlife Habitat in Pennsylvania: Past, Present, and Future*. Harrisburg, PA: PA-DCNR.
- Gould PJ, Steiner KC, Finley JC, McDill ME. 2005. Developmental Pathways following the Harvest of Oak-Dominated Stands. *Forest Science* 51(1):76-90.
- Gribko LS, T. M. Schuler, W. M. Ford. 2002. Biotic and abiotic mechanisms in the establishment of northern red oak seedlings: a review. Gen Tech. Rep. NE-295. Newtown Square, PA: USDA Forest Service, NE Research Station.
- Grief GE, O.W. Archibold. 2000. Standing-dead component of the boreal forest in central Saskatchewan. *For. Ecol. Mngt.* 131:37-46.
- Griffiths FR. 1983. Baseline Data Surveys: Fish and Invertebrate Diversity and Abundance and Water Quality Analysis in the Chappel Fork Drainage, ANFUS Fish and Wildlife Service.
- Grigal DF. 2000. Effects of extensive forest management on soil productivity. *Forest Ecology and Management* 138:167-85.
- Grisez T, Peace R. 1973. Requirements for advance regeneration in Allegheny hardwoods – an interim guide. USDA For. Serv. Res. Note NE-180.
- Groves CR. 2003. *Drafting a Conservation Blueprint. A Practitioner's Guide to Planning for Biodiversity*. Washington D.C., USA: Island Press.

- Grund, Steve. 2006. Western Pennsylvania Conservancy botanist. Personal communication regarding small-whorled pogonia and northeastern bulrush.
- Gucinski H, M.J. Furniss, F.F. Ziemer, M.H. Brookes. 2000. Forest Roads: A Synthesis of Scientific Information. USDA Forest Service.
- Gucinski H, Neilson R, McNulty S. 2004. Implications of Global Climate Change for Southern Forests: Can We Separate Fact from Fiction? In: Rauscher, H.M. and K. Johnson (eds.), Southern forest science: past, present, and future. Gen. Tech. Rep. SRS-75. Chapter 31. pp 365-371. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Gullion SW. 1972. Improving Your Forest Land for Ruffed Grouse; Paper No. 1439. Minnesota Ag. Exper. Station.
- Guynn DCJr, S.T. Guynn, T.B. Wigley, D.A. Miller. 2004. Herbicides and forest biodiversity, what do we know and where do we go from here?. Quoted In: Wildlife Society. 2004. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. Wildlife Society Bulletin 32:1049-1060.
- Hall D. 2004. Forest Service Disturbed WEPP Interface. Version 2004.02.18.
- Hallett RA, S. W. Bailey, S. B. Horsley, R. P. Long, T.J. Hall. 1999. Foliar chemistry of sugar maple: A regional view in sugar maple ecology and health: Proceedings of an International Symposium, June 2-4, 1998, Warren, Pennsylvania. Edited by S. B. Horsley and R. P. Long. USDA Forest Service General Technical Report NE-261.
- Hamel PB. 2000. Cerulean warbler *Dendroica cerulean*. In: A. Poole and F. Gill, editors. The birds of North America series, No. 511. Philadelphia, PA. 20 pp.
- Hamel PB. 2006. Adaptive Forest Management for Cerulean Warbler. Proceedings of Society of American Foresters National Convention. In press.
- Hamel PB, K.V. Rosenberg. 2006. Developing management guidelines for cerulean warbler breeding habitat. Proceedings of the 15th Central Hardwoods Forest Conference, Knoxville TN. 12pp . In press.
- Hamid A, ODell TM, Katovich S. 1995. White Pine Weevil, Forest Insect & Disease Leaflet 21. U.S. Department of Agriculture, Forest Service.
- Hane EN. 2003. Indirect effects of beech bark disease on sugar maple seedling survival . Canadian Journal of Forest Research (33):807-13.
- Haney JC. 1996. Policy aspects of old-growth forest reserves in the eastern U.S. In Mafumdar, S.K. Forests – A Global Perspective.
- Haney JC, C.P. Schaadt. 1996. Functional roles of eastern old growth in promoting forest bird diversity. In Eastern Old Growth Forests edited by M. B. Davis. Washington D.C., USA: Island Press.
- Haney, J. C.; Wilbert, M.; De Grood, C.; Lee, D. S.; Thomson, J. 2000. Gauging the Ecological Capacity of Southern Appalachian Reserves: Does Wilderness Matter? In: Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Harmon ME, W.K. Ferrell, J. F. Franklin. 1990. Effects on carbon storage of conversion of old-growth forests to young forests. Science (247):699-702.
- Harvey H. 1995. Pennsylvania Biodiversity Model (draft). Penn State University. 89pp.
- Hassinger J. 2000. Rights-of-Way as of Y2K: An Inventory of Access Corridors – The Pennsylvania Story. Presentation given at the Pennsylvania Wildlife Society Meeting, April 2, 2000, Titusville, PA, that included research results from Findlay, S. and J. Bourdages. 2000. Response Time of Wetland Biodiversity to Road Construction on Adjacent Lands. Conservation Biology. 14: 86-94 and Haskel, D. 2000. Effects of Forest Roads on Microinvertebrate Soil Fauna of the Southern Appalachian Mountains. Conservation Biology 14: 57-63.
- Haufler JB. 1999. Strategies for conserving terrestrial biological diversity. In: Baydack, R. K., H.Campa III, and J. B. Haufler, editors. Practical approaches to the conservation of biological diversity. Washington, D. C.: Island Press.

- Haynes RW, Technical Coordinator. 2003. An Analysis of the Timber Situation in the United States: 1952 to 2050. General Technical Report PNW-GTR-560. Portland, Oregon: United States Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Hays M. 2001. Community Study Comparing the Flora of a Managed Oak Stand to an Adjacent Unmanaged Oak Stand. Unpublished.
- Hays M. 2001a. Wetland Surveys on the ANF 2000-2001. ANF unpublished report. 7pp.
- Hays M. 2002. Bradford District Botanist. Personal communication.
- Healy WM. 1997. Thinning New England oak stands to enhance acorn production. *Northern Journal of Applied Forestry* (14):152-6.
- Healy WM. 2002. Managing Eastern Oak Forests for Wildlife. In: W.J. McShea and W.M. Healy editors, 2002, *Oak Forest Ecosystems, Ecology and Management for Wildlife*. pp 317-332. Baltimore, MD: The John Hopkins University Press.
- Heard WH. 1979. Hermaphroditism in Elliptio (Pelecypoda: Unionidae). *Malacological Review* (12):21-8.
- Henretta JE. 1929. *Kane and the Upper Allegheny*. Philadelphia, Pennsylvania: John C. Winston Co.
- Hilt, Donald, E.; Teck, R. M. 1989. NE-TWIGS: An individual-tree growth and yield projection system for the Northeastern United States. *Compiler*. 7(2): 10-16.
- Hoffman R, J.F. Palmer. 1996. Silviculture and forest aesthetics within stands. New York Center for Forestry Research and Development, Publication #2. Syracuse, New York: SUNY College of Environmental Science and Forestry.
- Hoover CM, R. A. Birdsey, L. S. Heath, S. L. Stout. 2000. How to estimate carbon sequestration on small forest tracts. *Journal of Forestry* (98):13-9.
- Hornbeck JW, J. N. Kochenderfer. 2000. Linkages between forest and streams: A perspective in time. In: *Riparian Management in Forests of the Continental Eastern United States*. Edited by E.S. Verry, J.W. Hornbeck, and C.A. Dolloff. Chapter 5, pg 91.
- Hornbeck JW, M. B. Adams, E. S. Corbett, E. S. Verry, J. A. Lynch. 1993. Long-term impacts of forest treatments on water yield: a summary for northeast USA. *Journal of Hydrology* (150):323-44.
- Hornbeck JW, W.T. Swank. 1992. Watershed ecosystem analysis as a basis for multiple-use management of eastern forests. *Ecological Applications* (2):238-47.
- Hornbeck JW, Leak WB. 1992. Ecology and management of Northern hardwood Forests in New England. General technical Report NE-159. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.
- Horsley SB. 1981. Control of Herbaceous Weeds in Allegheny Hardwood Forests with Herbicides. *Weed Science* 29:655-62.
- Horsley SB. 1982. Development of Reproduction in Allegheny Hardwood Stands after Herbicide-Clearcuts and Herbicide-Shelterwood Cuts. USDA Forest Service, Research Note NE-308.
- Horsley SB. 1988. Site Preparation for Regeneration of Allegheny Hardwoods. *Forestry Herbicides in the Northeast*.
- Horsley SB. 1988a. Control of Understory Vegetation in Allegheny Hardwood Stands with Oust. *Northern Journal of Applied Forestry* 5(4):261-2.
- Horsley SB. 1990a. Memorandum containing Guidelines for Use of More than One Herbicide.
- Horsley SB. 1990b. Control of Grass and Sedge in Allegheny Hardwood Stands with Roundup-Residual Herbicide Tank Mixes. *Northern Journal of Applied Forestry* 7(3):124-9.
- Horsley SB. 1990c. Tank Mixing Roundup with Adjuvants and Other Herbicides for Striped Maple Control. *Northern Journal of Applied Forestry* 7(1):19-22.
- Horsley SB. 1991. Using Roundup and Oust to control interfering understories in Allegheny hardwood stands. McCormick LH, Gottschalk KW. Central Hardwood For. Conf., General Technical Report NE-148. University Park, PA. Radnor, PA: USDA Forest Service.

- Horsley SB. 1994. Regeneration success and plant species diversity of Allegheny hardwood stands after Roundup application and shelterwood cutting. *Northern Journal of Applied Forestry* 11(4):109-16.
- Horsley SB. 1995. Facilitation of plant-plant interference by herbivory in the Allegheny hardwood forest, Pennsylvania, USA: a vegetation management problem. In: Gaskin, E.R.; Zabkiewicz, J.A., comps. *Popular summaries from 2nd international conference on forest vegetation management*; 1995 March 20-24; Rotorua, NZ. FRI Bull. 192. Rotorua, NZ: New Zealand Forest Research Institute: 224-226.
- Horsley SB, D.A. Marquis. 1983. Interference by weeds and deer with Allegheny hardwood reproduction. *Canadian Journal of Forest Research* (13):61-9.
- Horsley SB, J.C. Bjorkbom. 1983. Herbicide Treatment of Striped Maple and Beech in Allegheny Hardwood Stands. *Forest Science* 29(1):103-12.
- Horsley SB. 1993. Mechanisms of interference between hay-scented fern and black cherry . *Canadian Journal of Forest Research* 23(10):2059-69.
- Horsley SB, L.R. Auchmoody, R.S. Walters. 1994. Regeneration principles and practices. Pages 205-246 in Marquis, David A., editor. *Quantitative silviculture for hardwood forests of the Alleghenies*. General Technical Report NE-183. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station .
- Horsley SB, R. P. Long, S. W. Bailey, R. A. Hallett, P.M. Wargo. 2002. Health of eastern North American sugar maple forests and factors affecting decline. *Northern Journal of Applied Forestry* (19):33-34.
- Horsley SB, R. P. Long, S. W. Bailey, R. A. Hallett, T. J. Hall. 1999. Factors contributing to sugar maple decline along topographic gradients on the glaciated and unglaciated Allegheny Plateau. In: *Sugar Maple Ecology and Health: Proceedings of an International Symposium*. Edited by S.B. Horsley and R.P. Long. USDA Forest Service General Technical Report NE-261.
- Horsley SB, R.P Long, S.W. Bailey, R.A. Hallett, T.J. Hall. 2000. Factors associated with the decline disease of sugar maple on the Allegheny Plateau. *Canadian Journal of Forest Resources* (30):1365-78.
- Horsley SB, Stout SL, DeCalesta DS. 2003. White-tailed deer impact on the vegetation dynamics of a northern hardwood forest. *Ecological Applications*, Ecological Society of America 13(1):98-118.
- Horsley S, et al. 1998. Lecture notes for Allegheny Hardwood Training regarding regeneration principles and practices. unpublished.
- Horsley SB. 2005. Personal communication regarding atmospheric deposition on Allegheny Plateau.
- Horsley SB. 2005b. Lecture notes from 2005 Allegheny Hardwood Training titled "Practices for Obtaining Allegheny and Northern Hardwood Regeneration". unpublished.
- Horsley SB, McCormick LH, Groninger JW. 1992. Effects of Timing of Oust Application on Survival of Hardwood Seedlings. *Northern Journal Applied Forestry* 9(1):22-7.
- Horsley S, Hallett R, Bailey S, Long B. 2005a. Lecture notes from 2005 Allegheny Hardwood Training titled "Sugar Maple Decline in Northeastern Forests". unpublished.
- Hough, A. F. 1935. Technical Note No. 6. Relative Height Growth of Allegheny Hardwoods. Allegheny Forest Experiment Station.
- Hough AF. 1936. A climax forest community on East Tionesta creek in Northwest Pennsylvania. *Ecology* 17(1).
- Hough AF. 1963. What a glaze storm brings. *PA Forestry* (53):4-5.
- Hough AF. 1965. A twenty-year record of understory vegetational change in a virgin Pennsylvania forest. *Ecology* (46):370-3.
- Hough AF, R.D. Forbes. 1943. *The Ecology and Silvics of Forests in the High Plateaus of Pennsylvania*. Ecological Monographs 13(3):300-20.
- Houston DR. 2005. Beech Bark Disease: 1934 to 2004: What's New Since Ehrlich? Keynote Address. In: Evans, Celia A., Lucas, Jennifer A. and Twery, Mark J., eds. *Beech Bark Disease: Proceedings of the Beech Bark Disease Symposium*. Saranac Lake, NY. June 16-18, 2004. General Technical Report NE-331. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.

- Hoyt SF. 1992. in Brauning, D.W. 1992. Atlas of Breeding Birds in Pennsylvania. Pittsburgh, Pennsylvania, USA: University of Pittsburgh.
- Hrubocvak M. 2001. Personal communication. Status of State Scenic Rivers on the Allegheny National Forest.
- Hughes L. 2000. Biological consequences of global warming: is the signal already apparent? *TREE* 15(2):56-61.
- Hunter JrML. 1990. Wildlife, Forests, and Forestry. Principles of Managing Forests for Biodiversity. Englewood Cliffs, New Jersey, USA: Regents/Prentice Hall.
- Hunter ML. 1996. Fundamentals of Conservation Biology. Cambridge, Massachusetts, USA: Blackwell Science.
- Hunter WC, D.A. Buehler, R.A. Canterbury, J.L. Confer, P.B. Hamel. 2001. Conservation of Disturbance Dependent Birds in Eastern North America. *Wildlife Society Bulletin* (29):440-55.
- Husch B. 1954. The Regeneration of *Prunus serotina* in Northwestern Pennsylvania Following Cutting. *Ecology* 35(1):11-7.
- Hutchinson TC, Watmough SA, Sager EPS, Karagatzides JD. 1998. Effects of excess nitrogen deposition and soil acidification on sugar maple (*Acer saccharum*) in Ontario, Canada: an experimental study. *Canadian Journal of Forest Research* 28:299-310.
- Ilhardt B, Verry ES, Palik BJ. 2000. Defining Riparian Areas. Ch 2: 24 in Elon S. Verry, James W. Hornbeck and C. Andrew Dolloff editors. *Riparian Management in Forests of the Continental Eastern United States*. Boca Raton, FL: Lewis Publishers.
- Iverson LR, Prasad AM. 2002. Potential redistribution of tree species habitat under five climate change scenarios in the eastern US. *Forest Ecology and Management* (155):205-22.
- Iverson LR, Schwartz MW, Prasad AM. 2004. Potential colonization of newly available tree-species habitat under climate change: an analysis for five eastern US species. *Landscape Ecology* (19):787-99.
- Jacobson M. 2005. Personal communication regarding harvest trends, values and demand.
- Jenkins DH, D.A. Devlin, N.C. Johnson, S.P. Orndorff. 2004. System design and management for restoring Penn's woods. *Journal of Forestry* (102):30-6.
- Jenny H. 1994. Factors of Soil Formation: A System of Quantitative Pedology. New York, New York, USA: Dover Publications.
- Johnson CE, R. B. Romanowicz, T. G. Siccama. 1997. Conservation of exchangeable cations after clear-cutting of a northern hardwood forest. *Canadian Journal of Forest Resources* (27):859-68.
- Johnson DW, D. E. Todd. 1998. Harvesting effects on long-term changes in nutrient pools of mixed oak forest. *Soil Science Society of America Journal* (62):1725-35.
- Johnson PS. 1993. Perspectives on the Ecology and Silviculture of Oak-Dominated Forests in the Central and Eastern States; General Technical Report NC-153. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station.
- Johnson PS, S.R. Shifley, R.Rogers. 2002. The Ecology and Silviculture of Oaks. New York, New York, USA: CABI Publishing.
- Johnson PS. 1997. The Silviculture of Upland Central Hardwoods: 25 Years of Change. In: Proceedings of the Twenty-Fifth Annual Hardwood Symposium, 25 Years of Hardwood Silviculture: A Look Back and a Look Ahead. Edited by Dan A. Meyer. Cashiers, North Carolina, May 7-10 1997.
- Johnson RL, Krinard RM. 1983. Development of Seven hardwood Species in Small Forest Openings, 22-Year Results. *Southern Journal of Applied Forestry* 7(3):153-6.
- Johnson WC, J. B. Richardson, A. S. Bohnert. 1979. Archaeological site Survey in Northwest Pennsylvania, Region IV. Report submitted to the PA Historical and Museum Commission. Harrisburg, PA.
- Jones KB, K. H. Ritters, J. D. Wickham, R. D. Tankersley Jr., R. V. O'Neill, D. J. Chaloud , E. R. Smith, A. C. Neale. 1997. An Ecological Assessment of the United States Mid-Atlantic Region: A Landscape Atlas; EPA/600/R-97/130. Washington, DC: EPA Office of Research & Development.

- Jones SB, D. S. deCalesta, S. E. Chunko. 1993. Whitetails are changing our woodlands. *American Forests* (Nov/Dec: 20-25):53-4.
- Jones SB, James C. Finley. 1993. Public Forest Stewardship Ethic. [Web Page]. Located at <http://www.joe.org/joe/1993fall/a1.html>. Accessed 2007 Jan 25. *Journal of Extension*. Volume 31, Number 3.
- Jones J. 2000. Assessing conservation utility: a case study of the cerulean warbler in eastern Ontario. Ph.D. dissertation, Queens University, Kingston, Ontario. Quoted In: P.B. Hamel. 2006. Adaptive Forest Management for Cerulean Warbler. Proceedings of Society of American Foresters National Convention. In press.
- Joyce L, John Aber, Steve McNulty, Virginia Dale, Andrew Hansen, Lloyd Irland, Ron Neilson, Kenneth Skog, advisory committee. 2001. Climate Change Impacts on the United States, Report for the US Global Change Research Program. pages 489-521. Cambridge, UK: Cambridge University Press.
- Kassar C. 2005. Motorized Recreation at a Crossroads: Lessons from the Past Converge with Management Practices of the Future. Off-Road Vehicle Use on Public Lands.
- Keller JK, Richmond ME, Smith CR. 2003. An explanation of patterns of breeding bird species richness and density following clearcutting in northeastern USA forests. *Forest Ecology and Management* 174:541-64.
- Kelty MJ, Kittredge DB, Kyker-Snowman T, Leighton AD. 2003. The Conversion of Even-Aged Stands to Uneven-Aged Structure in Southern New England. *Northern Journal of Applied Forestry* 20(3):109-16.
- Keystone Wild Notes. 2005. PA Rattlesnakes victims of hatred, habitat destruction. Wild Resource Conservation Program.
- Kimmel JT, R.H. Yahner. 1994. The Northern Goshawk in Pennsylvania. Habitat Use, Survey Protocols and Status. Final Report. State College, PA: School of Forestry Resources. Penn State University.
- Kimmins JP. 1997. *Forest Ecology: A Foundation for Sustainable Management*. Second ed. New Jersey, USA: Prentice Hall.
- King DI, C.R. Griffin, R.M. DeGraaf. 1999. Nest predator distribution among clearcut forest, forest edge and forest interior in an extensively forested landscape. *Forest Ecology and Management* 104(1-3):151-6.
- King DI, R.M. DeGraaf, C.R. Griffen. 1998. Edge-related nest predation in clearcut and groupcut stands. *Conservation Biology*. 10:1380-1386. Quoted in: J.C. Manolis, D.E. Anderson and F.J. Cuthbert. 2002. Edge Effect on Nesting Success of Ground Nesting Birds Near Regenerating Clearcuts in a Forest-Dominated Landscapes. *The Auk*. 119(4): 955-970.
- King JG. 1979. Fillslope erosion from forest roads. In: Proceedings, 34th meeting, 1979 October 3-5; Boise, Idaho. Pap. 79-404. St. Joseph, MI. American Society of Agricultural Engineers.
- Klotzbach J, Durkin P. 2004. Sulfometuron Methyl - Human Health and Ecological Risk Assessment - Final Report. SERA TR 03-43-17-02c.
- Knauer K, J. Linnane, K. Shields, R. Bridges. 2002. An Initiative for Management of Hemlock Woolly Adelgid. In Onken, B., R. Reardon and J. Lashomb (eds.), Proceedings, Hemlock Woolly Adelgid in Eastern North America Symposium. Feb. 5-7, 2002. East Brunswick, NJ, USA. N.J. Agriculture Experiment Station, Rutgers State University of New Jersey, and USDA: pp 9-11.
- Knoepp JD, W. T. Swank. 1997. Long-term effects of commercial sawlog harvest soil cation concentrations. *Forest Ecological Management* (93):1-7.
- Kochender JN, Kochenderfer JD. 2005. Using Manual Herbicide Application Methods to Manage Vegetation: Personal Communication.
- Kochenderfer J. 2006. Personal communication regarding cut surface herbicide application, beech sprouts and translocation of herbicides.
- Kochenderfer JD, Kochenderfer JN, Miller GW. 2006. Controlling Beech Root and Stump Sprouts Using the Cut-Stump Treatment. *Northern Journal of Applied Forestry* 23(3):155-165.
- Kochenderfer JD, Kochenderfer JN, Warner DA, Miller GW. 2004. Preharvest Manual Herbicide Treatments for Controlling American Beech in Central West Virginia. *Northern Journal of Applied Forestry* 21(1):40-9.

- Kochenderfer JD, Zedaker SM, Johnson JE, Smith DWm, Miller GW. 2001. Herbicide Hardwood Crop Tree Release in Central West Virginia. *Northern Journal of Applied Forestry* 18(2):46-54.
- Kohm KA, J.F. Franklin. 1997. Creating a Forestry for the 21st Century. *The Science of Ecosystem Management*. Washington, DC and Covelo, California, USA: Island Press.
- Kuhlman EG. 1978. The Devastation of American Chestnut by Blight. In: *Proceedings of the American Chestnut Symposium*, January 4-5, 1978, Morgantown, WV.
- Lancaster K. 1985. Managing Eastern Hemlock- A Preliminary Guide. NA-FR-30.
- Landers JL. 1987. Prescribed Burning for Managing Wildlife in Southeastern Pine Forests. Quoted In: USDA-FS 2000. *The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions*. *Proceedings of a Special Workshop*. Nashville, TN. General Technical Report NE-288. 147 pp.
- Lantz SW. 1969. Rockshelters (Trail Shelters) of the Upper Allegheny. *The Society for Pennsylvania Archaeology*, Kinzua Chapter No. 18.
- Lantz SW. 1982. A Cultural Resource Survey of L.R. 93 (T.R. 62), Irvine Bridge, located near the town of Irvine, Warren County, Pennsylvania. Report submitted to Kozel Engineering Co., Inc. by the Division of Anthropology. Pittsburgh, Pennsylvania: The Carnegie Museum of Natural History.
- Lantz SW. 1984. The Distribution of Paleo-Indian Projectile Points and Tools from Western Pennsylvania: Implications for Regional Distributions. Pages 210-230 in *Archaeology of Eastern North America* Vol. 12.
- Lantz SW. 1985. Western Pennsylvania: Appalachian Plateau and Lake Erie Shore Paleo-Indian Period Pages 164-181 in: *A Comprehensive State Plan for the Conservation of Archaeological Resources* Volume I. Pennsylvania Historical and Museum Commission. Historic Preservation Planning Series, Number 1.
- Lantz SW. 1989. Age, distribution and cultural affiliation of raccoon notched point varieties in western Pennsylvania and western New York. *Bulletin of Carnegie Museum of Natural History* No. 28.
- Lassiter RR, Box EO, Wiegert RG, Johnston JM, Bergengren J, Suarez LA. 2000. Vulnerability of Ecosystems of the Mid-Atlantic Region, USA, to Climate Change. *Environmental Toxicology and Chemistry* 19(4(2)):1153-60.
- Latham RE, Beyea J, Benner M, Dunn CA, Fajvan MA, Freed RR, Grund M, Horsley SB, Rhoads AF, Shissler BP. 2005. Executive Summary: Managing white-tailed deer in forest habitat from an ecosystem perspective: Pennsylvania Case Study. Report by the Deer Management Forum for Audubon Pennsylvania and Pennsylvania Habitat Alliance. Harrisburg, PA.
- Latty EF, C.D. Canham, P.L. Marks. 2003. Beech bark disease in northern hardwood forests: the importance of nitrogen dynamics and forest history for disease severity. *Canadian Journal of Forest Research* (33):257-68.
- Laurance WF, Yensen. 1991. In Davidson, Carlos. 1998. *Issues in Measuring Landscape Fragmentation*. *Wildlife Society Bulletin* (26):32-7.
- Leak WB, Filip SM. 1977. Thirty-eight Years of Group Selection in New England Northern hardwoods. *Journal of Forestry* 75(10):641-3.
- Leak, William B.; Solomon, Dale S.; DeBald, Paul S. 1987. *Silvicultural guide for northern hardwood types in the Northeast* (revised). Res. Pap. NE-603. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.
- Leak WB. 1996. Long-term structural change in uneven-aged northern hardwoods. *Forest Science* (42):160-5.
- Leak WB. 1999. Species composition and structure of a northern hardwood stand after 61 Years of group/patch selection. *Northern Journal of Applied Forestry* 16(3):151-3.
- Leak WB. 2006. Fifty-Year Impacts of the Beech Bark Disease in the Bartlett Experimental Forest, New Hampshire. *Northern Journal of Applied Forestry* 23(2):141-3.

- Lehmkuhl JF, L.F. Ruggiero. 1991. In: Davidson, Carlos. 1998. Issues in Measuring Landscape Fragmentation. Wildlife Society Bulletin (26):32-7.
- Lhotka JM, Zaczek JJ. 2003. Effects of Scarification Disturbance on the Seedling and Midstory Layer in a Successional Mixed-Oak Forest. Northern Journal of Applied Forestry 20(2):85-91.
- Liechty HO, M. G. Shelton, K. R. Luckow, D. J. Turton. 2002. Impacts of shortleaf pine-hardwood forest management on soils in the Ouachita highlands: A review. Southern Journal of Applied Forestry (26):43-51.
- Likens GE, C.T. Driscoll, D.C. Buso, T.G. Siccama, C.E. Johnson, G.M. Lovett, T.J. Fahey, W.A. Reiners, D.F. Ryan, C.W. Martin and others. 1998. The biogeochemistry of calcium at Hubbard Brook. Biogeochemistry (41):89-173.
- Lindenmayer DB, Jerry F. Franklin. 2002. Conserving Forest Biodiversity: A Comprehensive Multiscaled Approach. Washington D.C., USA: Island Press.
- Litvaitis JA. 2003. Are pre-Columbian conditions relevant baselines for managed forests in the northeastern United States? Forest Ecology and Management (185):113-26.
- Litvaitis JA. 2003a. Shrublands and early-successional forest: critical habitats dependent on disturbance in the northeastern United States. Preface In Forest Ecology and Management (185):1-4.
- Loewenstein EF, H.E. Garrett, P.S. Johnson, J. P. Dwyer. 1995. Changes in a Missouri Ozark Oak-Hickory Forest during 40 Years of Uneven-Aged Management. Tenth Central Hardwood Forest Conference.
- Loftis DL. 2004. Upland Oak Regeneration and Management. In: Upland oak ecology symposium: History, current conditions, and sustainability. Edited by M.A. Spetich. Gen. Tech. Rep. SRS-73. pp 163-167. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Long RP, S.B. Horsley, P.R. Lilja. 1997. Impact of forest liming on growth and crown vigor of sugar maple and associated hardwoods. Canadian Journal of Forest Research (27):1560-73.
- Long RP, S.B. Horsley, P.R. Lilja. 1999. Impact of forest liming on growth, vigor, and reproduction on sugar maple and associated hardwoods. Pages 55-62 in: Sugar maple ecology and health- Proceedings of an International Symposium; General Technical Report NE-261. USDA Forest Service, Northeastern Research Station.
- Loomis JB. 2000. Economic values of wilderness recreation and passive use: what we think we know at the beginning of the 21st century. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, compiler. 2000. Wilderness science in a time of change conference - Volume 2: Wilderness within the context of larger systems; 1999 May 23-27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. pp 5-13. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Lord BE, Elmendorf WF, Strauss CH. 2004. Pennsylvania's ATV riders and their needs. Report to Bureau of Recreation and Conservation. Harrisburg, PA: Pennsylvania Department of Conservation and Natural Resources.
- Lord BE, M. J. Powell, C.H. Strauss. 2003. Tourism in Northcentral Pennsylvania: Visitor Characteristics and Economic Impacts. University Park, PA: School of Forest Resources, Pennsylvania State University.
- Lorimer CG, A.S. White. 2003. Scale and frequency of natural disturbances in the northeastern US: implications for early successional forest habitats and regional age distributions. Forest Ecology and Management (185):41-64.
- Lowenstein, EF. 1998. Personal communication regarding site selection for uneven-aged management in oak forest types.
- Lorimer CG, L.E. Frelich. 1994. Natural disturbance regimes in old-growth northern hardwoods. Journal of Forestry (92):33-8.
- Lovett GM, Mitchell MJ. 2004. Sugar maple and nitrogen cycling in the forests of eastern North America. Front. Ecol. Environ. 2(2):81-8.
- Lugo AE, H. Gucinski. 1999. Function, effects, and management of forest roads. Forest Ecology and Management (133):249-62.

- Luppold WG, J.E. Baumgras, R.M. Sheffield.
Unpublished. 1997. A Comparative Analysis of
Hardwood Sawtimber Quality on National Forests
Versus Adjacent Lands for submission to Forest
Products Journal. Asheville, NC: Southern Research
Station.
- Lutz HJ. 1930. The vegetation of Heart's Content, a
virgin forest in northwestern Pennsylvania. *Ecology*
11(1):1-29.
- Lynch JA, K.S. Horner, J.W. Grimm. 2002. Atmospheric
Deposition: Spatial and Temporal Variations in
Pennsylvania. University Park, Pennsylvania: Penn
State Institutes of the Environment. The Pennsylvania
State University.
- Lynch JA, Edward S. Corbett. 1990. Evaluation of Best
Management Practices for Controlling Nonpoint
Pollution From Silvicultural Operations. *Water
Resources Bulletin* 26(1):41-52.
- Lyon LJ, H.S. Crawford, E. Czuhai, R.L. Fredriksen, F.
Harlow, L.J. Metz, H.A. Pearson. 1978. Effects of
fire on fauna: a state-of-the-knowledge review.
General Technical Report WO-6. Washington DC:
U.S. Department of Agriculture, Forest Service.
- MacFaden SW, D.E. Capen. 2002. Avian Habitat
Relationships at Multiple Scales in a New England
Forest.
- MacKenzie M. 2004. Personal communication regarding
Beech Bark Disease killing front.
- MacKenzie M. 2005a. Beech Bark Disease Aftermath
Forest on the Allegheny National Forest.
unpublished. Morgantown, WV: USDA-FS, Forest
Health Protection.
- MacKenzie M. 2005b. The rate of spread of BBD over the
ANF. unpublished. Morgantown, WV: USDA-FS,
Forest Health Protection.
- Mackenzie M, R. Acciavatti. 1995. Another perspective
towards understanding the forest health issue of
maple decline and mortality in the Allegheny
National Forest.
- Malm WC. 1999. Section 6 In: Introduction to Visibility.
Under Cooperative Agreement CA2350-97-001:
T097-04, T098-06. CIRA. Fort Collins, CO.
- Manion PD. 1991. Tree Disease Concepts. Second ed.
New Jersey, USA: Prentice Hall Career &
Technology.
- Manolis JC, D.E. Andersen, F.J. Cuthbert. 2002. Edge
Effect on Nesting Success of Ground Nesting Birds
Near Regenerating Clearcuts in a Forest-Dominated
Landscape. *The Auk* 119(4):955-70.
- Marks PL. 1974. The role of pin cherry (*Prunus
pensylvanica* L.) in the maintenance of stability in
northern hardwood ecosystems. *Ecological
Monographs* (Winter 1974) 44(1):73-88.
- Marquis DA. 1975. The Allegheny hardwood forests of
Pennsylvania: Their Bounty of Timber and Deer are
the Results of Events that Occurred Many Years Ago.
USDA Forest Service General Technical Report NE-
15. Upper Darby, Pennsylvania.
- Marquis DA. 1990. *Prunus serotina* Ehrh. Black Cherry
In: *Silvics of North America, Volume 2, Hardwoods*;
Agriculture Handbook 654. R.M. Burns and B.H.
Honkala, editors. pp 594-604. Washington, DC,
USA: USDA Forest Service.
- Marquis DA, editor. 1994. History and origin of
Allegheny forests. In *Quantitative silviculture for
hardwood forests of the Alleghenies*; General
Technical Report NE-183. USDA Forest Service,
Northern Forest Experiment Station.
- Marquis DA, editor. 1994a. Quantitative Silviculture for
Hardwood Forests of the Alleghenies; General
Technical Report NE-183. USDA Forest Service.
- Marquis DA. 1994b. Thinning Principles and Practices:
Control of Stand Density, Structure, and Species
Composition During Thinning in Hardwood Stands
in the Alleghenies. Pages 247-287 In: *Quantitative
silviculture for hardwood forests of the Alleghenies*.
Marquis, David A., editor. USDA Forest Service
Northeastern Forest Experiment Station General
Technical Report NE-183.
- Marquis DA, J.C. Bjorkbom. 1982. Guidelines for
Evaluating Regeneration Before and After
Clearcutting Allegheny Hardwoods; Research Note
NE-307. USDA FS Northeastern Forest Experiment
Station.

- Marquis DA, R. Brenneman. 1981. The Impact of Deer on Forest Vegetation in Pennsylvania; General Technical Report NE-65. Broomall, Pennsylvania, USA: Northeast Forest Experiment Station.
- Marquis DA, R.L. Ernst, S.L. Stout. 1992. Prescribing silvicultural treatments in hardwood stands of the Allegheny (Revised). General Technical Report NE-96. Radnor, PA: USDA-Forest Service. Northeastern Forest Experiment Station.
- Marquis DA, R.L. Johnson. 1989. Silviculture of eastern hardwoods. In *The Scientific Basis for Silviculture and Management Decisions in the National Forest System*. pp 9-17, Edited by Russel M. Burns. USDA Forest Service General Technical Report WO-55.
- Marquis DA, T. J. Grisez. 1978. The effect of deer exclosures on the recovery of vegetation in failed clearcuts on the Allegheny Plateau; FS Research Note NE-270. USDA Forest Service.
- Marquis DA, Porter Gearhart. 1983. Cherry-Maple, pp 137-140. In: Burns, R.M. 1983. *Silvicultural Systems for the Major Forest Types of the United States*; Agriculture Handbook No. 445. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Martin AC, H. S. Zim, A. L. Nelson. 1961. *American Wildlife and Plants A guide to Wildlife Food Habits*. New York, NY: Dover Publications, Inc.
- Martin CW, J.W. Hornbeck, G.E. Likens, D.C. Buso. 2000. Impacts of intensive harvesting on hydrology and nutrient dynamics of northern hardwood forests. *Canadian Journal of Fisheries and Aquatic Sciences* (57):19-29.
- Maser C, J. M. Trappe. 1984. The seen and unseen world of the fallen tree; General Technical Report PNW-164. Pacific Northwest Forest and Range Experimental Station.
- Mathews D. 1942. *Cost Control in the Logging Industry*. New York, New York, USA: McGraw Hill.
- Mayer M, Chianese R, Scudder T, White J, Vongpaseuth K, Ward R. 2002. Thirteen Years of Monitoring the Hemlock Woolly Adelgid In New Jersey Forests: In *Symposium on the Hemlock Woolly Adelgid in Eastern North America*. pp 50-60. Onken B, R. Reardon, J. Lashomb, Editors. *Proceedings, Hemlock Woolly Adelgid in Eastern North America Symposium*. East Brunswick, NJ, USA. N.J. Agriculture Experiment Station, Rutgers State University of New Jersey and USDA.
- McClure MS, Cheah CAS-J. 2002. Important Mortality Factors in the Life Cycle of Hemlock Woolly Adelgid, *Adelges tsugae* Annand (Homoptera: Adegidae) in the Northeastern United States. Pages 13-22 In: *Symposium on the Hemlock Woolly Adelgid in Eastern North America*. Feb.5-7, 2002.
- McComb WC, G.A. Hurst. 1987. Herbicides and wildlife in southern forest. pp 28-36 in J.G. Dickson and O.E. Maughan, editors. *Managing southern forests for wildlife and fish*. U.S. Department of Agriculture, Forest Service, General Technical Report SO-65, Washington DC. Quoted In: Wildlife Society. 2004. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. *Wildlife Society Bulletin* 32:1049-1060.
- McGarigal K. 1998. In Davidson, Carlos. 1998. Issues in measuring landscape fragmentation. *Wildlife Society Bulletin* (26):32-7.
- McKean County Planning Commission, The Tuna Valley Council of Governments, The EADS Group, Inc. (Clarion). 2001. *Multi-Municipal Comprehensive Plan*, McKean County .
- McKenzie E. 1995. Important Criteria and Parameters of Wildlife Movement Corridors - A Partial Literature Review. Southern Columbia Mountains Environmental Sector of the West Kootenay CORE Table.
- McLaughlin JS, M.S. Caldwell, M.P. Brooks. 2002. A cultural resource reconnaissance report for the Lewis Run EIS Project. CRR #9-19-01-516. Reports of the Allegheny National Forest, Bradford District.

- McManus KA, K.S. Shields, D.R. Souto, editors. 2000. Proceedings: Symposium on Sustainable Management of Hemlock Ecosystems in Eastern North America; 1999 June 22-24; Durham NH. GTR NE-267. Newtown Square, PA: USDA Forest Service, Northeastern Research Station.
- McManus M, Schneeburger N, Reardon R, Mason G. 1989. Gypsy Moth; Forest Insect and Disease leaflet 162. U.S. Department of Agriculture, Forest Service.
- McNab WH, H. A. Froehlich. 1984. Conceptual Model for Predicting Forest Productivity Losses From Soil Compaction. In New forests for a changing world, Proc. Society of American Foresters National Convention, October 16-20, 1983. Portland, Oregon, USA .
- McNab WH, P. E. Avers, editors. 1994. Ecological subregions of the United States: Section descriptions. Publication WO-WSA-5. Washington, DC, USA: USDA Forest Service.
- McShea WJ, H.B. Underwood, J.H. Rappole. 1997. The science of overabundance: Deer ecology and population management. Washington: The Smithsonian Institution.
- McShea WJ, W.M. Healy, editors. 2002. Oak Forest Ecosystems: Ecology and Management for Wildlife. Baltimore, Maryland, USA: The Johns Hopkins University Press.
- McShea WJ, W.M. Healy. 2002. Oaks and Acorns as a Foundation for Ecosystem Management. In: Oak Forest Ecosystems Ecology and Management for Wildlife edited by W.J. McShea and W.M. Healy. Baltimore, MD: The Johns Hopkins University Press.
- McWilliams W, T. Bowersox, P. Brose, D. Devlin, J. Finley, K. Gottschalk, S. Horsley, S. King, B. LaPoint, T. Lister and others. 2005. Measuring Tree Seedlings and Associated Understory Vegetation in Pennsylvania's Forests. Ronald E. McRoberts, Gregory A. Reams, Paul C. Van Deusen, William H. McWilliams, Chris J. Cieszewski, Editors. Proceedings of the Fourth Annual Forest Inventory and Analysis Symposium: GTR-NC-252. New Orleans, LA.
- McWilliams WH, C.A. Alerich, D.A. Devlin, A.J. Lister, T.W. Lister, S.L. Sterner, J.A. Westfall. 2004. Annual Inventory Report for Pennsylvania's Forests: Results from the First Three Years: Resource Bulletin NE-159. Newtown Square, PA: USDA Forest Service.
- McWilliams WH, R.L. White, S.L. Arner, C.A. Nowak, S.L. Stout. 1996. Characteristics of Declining Forest Stands on the Allegheny National Forest. Research Note NE-360. Radnor, PA: USDA-Forest Service. Northeastern Forest Experiment Station.
- McWilliams WH, Stout SL, Bowersox TW, McCormick Larry H. 1995. Adequacy of Advance Tree-Seedling Regeneration in Pennsylvania's Forests. Northern Journal of Applied Forestry 12(4):187-91.
- Means DB, H.W. Campbell. 1981. Effects of prescribed burning on amphibians and reptiles. Quoted In: USDA-FS 2000. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions, Proceedings of a Special Workshop. Nashville TN. General Technical Report NE-288 147 pp.
- Megahan WF, J. Hornbeck. 2000. Lessons learned in watershed management: a retrospective view. USDA Forest Service Proceedings, RMRS-P-13.
- Mehrhoff LA. 1989. Reproductive vigor and environmental factors in populations of an endangered North American orchid, *Isotria medeoloides* (Pursh) Rafinesque. Biological Conservation 47(4):281-96.
- Meyer JL, Beilfuss R, Kaplan L, et al. 2003. Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands.
- Mielke EM, D.R Houston, A. T. Bullard. 1986. Beech Bark Disease Management Alternatives. Pages 272-279 in Proceedings- Integrated Pest Management Symposium for Northern Forests. University of Wisconsin.
- Miller KV, J.S.Witt. 1990.Impacts of forestry herbicides on wildlife. pp 795-800. In: Quoted In: Wildlife Society. 2004. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. Wildlife Society Bulletin 32:1049-1060.

- Miller GW, J.E. Johnson, J.E. Baumgras, R.G. Bustamente. 1997. Two-age silviculture on the Monongahela National Forest - Managers and scientists assess 17 years of communication. Pages 123-133 in Proceedings of the National Silviculture Workshop: Communicating the role of silviculture in managing National Forests, Warren, PA. May 19-22, 1997; General Technical Report NE-238. USDA Forest Service, Northeastern Forest Experiment Station.
- Miller GW, J. N. Kochenderfer. 1998. Maintaining species diversity in the central Appalachians. *Journal of Forestry* 98:28-33.
- Miller GW, P.B. Wood, J.V. Nichols. 1995a. Two-Age Silviculture - An innovative tool for enhancing species diversity and vertical structure in Appalachian hardwoods. Fort Collins, Colorado. In: Proceedings of the 1995 National Silviculture Workshop. Mescalero, NM. 6 p. USDA Forest Service General Technical Report RM-GTR-267 .
- Miller GW, T.M. Schuler. 1995. Method for Applying Group Selection in Central Appalachian Hardwoods. Tenth Central Hardwood Forest Conference.
- Miller GW. 2000. Effect of Crown Growing Space on the Development of Young Hardwood Crop Trees. *Northern Journal of Applied Forestry* 17(1):25-35.
- Miller GW, Kochenderfer JN, Gottschalk KW. 2002. Effect of Pre-Harvest Shade Control and Fencing on Northern Red Oak Seedling Development in the Central Appalachians. In: Spetich MA. Upland Oak Ecology, Symposium: History, Current Conditions and Sustainability. General Technical Report SRS-73.
- Miller GW, Kochenderfer JN, Keketulegn D. 2004. Composition and Development of Reproduction in Two-Age Appalachian Hardwood Stands: 20-Year Results. Shepperd WD, Eskew LG, compiler. *Silviculture in Special Places: Proceedings of the 2003 National Silviculture Workshop*. RMRS-P-34. Granby, CO.
- Miller GW, Schuler TM, Smith HC. 1995. Method for Applying Group Selection in Central Appalachian Hardwoods. Research Paper NE-696. Radnor, PA: USDA Forest Service, Northeastern Forest Experiment Station.
- Miller GW, Smith HC. 1993. A Practical Alternative to Single-Tree Selection. *Northern Journal of Applied Forestry* 10(1):32-8.
- Miller JH. 2002. Exotic Pest Plants and Their Control. Auburn, AL: U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Miller KV, Miller JH. 2004. Forestry herbicide influences on biodiversity and wildlife habitat in southern forests. *Wildlife Society Bulletin* 32(4):1049-60.
- Miller N. 1973. Late-glacial and Postglacial Vegetation Change in Southwestern New York State. *New York State Museum Bulletin* 420.
- Minckler LS. 1995. Forest Values and How to Sustain Them. Tenth Central Hardwood Forest Conference.
- Minckler LS, Woerheide JD, Schlesinger RC. 1973. Light, Soil Moisture, and Tree Reproduction in Hardwood Forest Openings. Research Paper NC-89. St. Paul Minnesota: USDA Forest Service, North Central Forest Experiment Station.
- Mladenoff DJ, M.A. White, T.R. Crow, J.P. Pastor. 1994. Applying principles of landscape design and management to integrate old-growth forest enhancement and commodity use. *Conservation Biology* (8):752-62.
- Monsanto Company. 1997. Background Sheet: Roundup and Earthworms.
- Moriarty WJ, L.M. DeMarco, B. Nelson, T. Steffan, B. Pence. 1996. "Draft Discussion Guide" - Riparian Ecosystem Management. USDA Forest Service Allegheny National Forest.
- Morin RS, A.M. Liebhold, K.W. Gottschalk, D.B. Twardus, R.E. Acciavatti, R.L. White, S.B. Horsley, W.D. Smith, E.R. Luzader. 2001. Forest Health Conditions on the Allegheny National forest (1989-1999): Analysis of Forest Health Monitoring Surveys. USDA Forest Service NA-TP-04-01. Newtown Square, PA.
- Morin RS. 2005. Personal communication regarding Black Cherry forest type for the ANF, the ANF four county area and the state of PA.

- Morin RS, Liebhold AM, Gottschalk KW, Woodall CW, Twardus DB, White RL, Horsley SB, Ristau TE. 2006. Analysis of Forest Health Monitoring Surveys on the Allegheny National Forest (1998-2001). General Technical Report NE-339. Newtown Square, PA: USDA Forest Service, Northeastern Research Station.
- Morrison ML, B. G. Marcot, R. W. Mannan. 1992. Wildlife-Habitat Relationships: Concepts and Applications. Madison, Wisconsin, USA: University of Wisconsin.
- Munson PJ. 1986. Hickory Silviculture: A Subsistence Revolution in the Prehistory of Eastern North America in Emergent Horticultural Economies of the Eastern Woodlands. Carbondale, IL: Southern Illinois University.
- Myers WL, J. A. Bishop. 1999. Eco-region Map for Pennsylvania. In: Goodrich, L. J., M. Brittingham, J. A. Bishop, and P. Barber. 2003. Wildlife Habitat in Pennsylvania: Past, Present, and Future. Harrisburg, PA: PA-DCNR.
- National Invasive Species Council (NISPC). 2001. Meeting the Invasive Species Challenge: National Invasive Species Management Plan.
- Nature Serve. 2004. Nature Serve Explorer: an online encyclopedia of life. Version 1.8 [Web Page]. Located at: <http://www.natureserve.org/explorer>. Accessed 2004 Mar 19.
- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 5.0 [Web Page]. Located at: <http://www.natureserve.org/explore>. Accessed 2007 Jan 11.
- Neary DG, Klopatek CC, DeBano LF, Pfolliott. 1999. Fire effects on belowground sustainability: a review and synthesis. *Forest Ecology and Management* (122):51-71.
- Neary DG, Ryan KC, DeBano LF, Editors. 2005. Wildland fire in ecosystems: effects of fire on soil and water. Gen. Tech. Rep. RMRS-GTR-42 vol 4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Nelson BB, K. Titus. 1989. Silviculture Practices and Raptor Habitat Associations in the Northeast. In: Proceedings of the Northeast Raptor Management Symposium and Workshop. National Wildlife Federation Scientific and Technical Series No 13. Washington, DC.
- Nicholson CP. 2004. Ecology of the Cerulean Warbler in the Cumberland Mountains of East Tennessee. Ph.D. Dissertation, University of Tennessee, Knoxville, TN. 93 pp. Quoted In: P.B. Hamel. 2006. Adaptive Forest management for Cerulean Warbler. Proceedings of Society of American Forester national Convention. In press.
- Nicholson DS, J. S. Ward. 1995. Fifty-Year Response of a 135-Year-Old White Pine Stand to Partial Thinning in Connecticut. Tenth Central Hardwood Forest Conference.
- Niemi E, E. Whitelaw. 1997. Assessing economic tradeoffs in forest management Page 78 in USDA Forest Service, Pacific Northwest Research Station General Technical Report PNW-GTR-403.
- Niese JN, T. F. Strong, G.G. Erdmann. 1995. Forty years of alternative management practices in second-growth, pole-size northern hardwoods. II. Economic evaluation. *Canadian Journal of Forest Research* (25):1180-8.
- NOAA. 1995. Climatological data. Asheville, North Carolina, USA: National Oceanic and Atmospheric Administration, Environmental Data and Information Service, National Climatic Center.
- Norris L. 1998. Water quality monitoring for herbicides in connection with vegetation management on electric utility rights-of-way on the Allegheny National Forest. Stoughton, Wisconsin, USA: Environmental Consultants.
- Noss R. 1984. The Ecological Effects of Roads. [Web Page]. Located at: <http://www.eco-action.org/dt/roads.html>. Accessed 2007 Jan 11.
- Noss RF. 1987. In Hunter, Malcolm, L. Jr. 1990. Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity. Englewood Cliffs, New Jersey: Regents Prentice Hall.
- Novotny V, H. Olem. 1994. Water Quality: Prevention, Identification, and Management of Diffuse Pollution. New York, New York: John Wiley and Sons.

- Nowak CA. 1997. Long-Term Sustainability: The Next Forest. In: *Proceedings of Forest Sustainability: What's It All About?* Penn State School of Resources Issues Conference. University Park, PA.
- Nyland R. 1996. *Silviculture Concepts and Applications*. New York, New York, USA: McGraw Hill.
- Nyland R. 1998. Personal communication regarding accelerating stands into an old-growth condition.
- Nyland R. 2004. Personal communication regarding silviculture and old-growth characteristics.
- Nyland RD. 1998. Selection system in northern hardwoods. *Journal of Forestry* 96(7):18-21.
- Nyland RD. 2003. Even- to uneven-aged: the challenges of conversion. *Forest Ecology and Management* (172):291-300.
- Nyland RD, Bashant AL, Bohn KK, Verostek JM. 2006. Interference to Hardwood Regeneration in Northeastern North America: Controlling Effects of American Beech, Striped Maple, and Hobblebush. *Northern Journal of Applied Forestry* 23(2):122-32.
- Office of Technology Assessment. 1987. *Technologies to Maintain Biological Diversity*. Washington, DC, USA: U.S. Government Printing Office.
- Oliver CD, B. C. Larson. 1990. *Forest Stand Dynamics*. New York, New York, USA: McGraw Hill.
- Oliver CD, B. C. Larson. 1996. *Forest Stand Dynamics Update Edition*. New York, USA: John Wiley and Sons, Inc.
- Ordiway LD. 1998. A comprehensive listing and explanation of amphibians, reptiles, birds and mammals found in the Allegheny National Forest and the physical attributes of a stand associated with their presence and usage. Unpublished.
- Orwig DA. 2002. Stand dynamics associated with chronic hemlock woolly adelgid infestations in southern New England. In Onken, B., R. Reardon and J. Lashomb (eds.), *Proceedings, Hemlock Woolly Adelgid in Eastern North America Symposium*. Feb. 5-7, 2002. pp 36-46. East Brunswick, NJ, USA: N.J. Agriculture Experiment Station, Rutgers State University of New Jersey, and USDA.
- Ostlie WR. 1990. *Stewardship Abstracts for Wiegand's Sedge and Darlington's Spruce*. Unpublished.
- Ostrofsky WD, D.R. Houston. 1989. Harvesting Alternatives for Stands Damaged by the Beech Bark Disease. Pages 173-177 in *Proceedings of the 1988 SAF National Convention*. No. 88-01. Rochester, New York, USA.
- Ostrofsky WD, Maxwell L. McCormack Jr. 1986. Silvicultural Management of Beech and the Beech Bark Disease. *Northern Journal of Applied Forestry* (3):89-91.
- Ostry ME, M.E. Mielke, D.D. Skilling. 1994. *Butternut-Strategies for Managing a Threatened Tree*. St. Paul, NM: USDA. Forest Service North Central Experiment Station General Technical Report NC-165.
- Page LM. 1983. *Handbook of Darters*. Neptune City, New Jersey, USA: Tropical Fish Hobbyist Publications.
- Parendes LA, Jones JA. 2000. Role of Light Availability and Dispersal in Exotic Plant Invasion along Roads and Streams in the H. J. Andrews Experimental Forest, Oregon. *Conservation Biology* 14(1):64-75.
- Parker AC. 1968. *Parker on the Iroquois*. W.N. Fenton, editor. Syracuse, New York, USA: Syracuse University Press.
- Parker GR, C. Merritt. 1995. The Central Region. In *Regional Silviculture of the United States*. Edited by John W. Barrett. p 147. 3rd ed. New York, NY: John Wiley & sons.
- Partners In Flight. 2001. *Landbird Conservation Plan*. Physiographic area 24. Allegheny plateau. Ithaca, New York: Cornell lab of ornithology.
- Paton PW. 1993. The effect of edge on avian nest success. How strong is the evidence? *Conservation Biology* (8):17-26.
- Penn State, Pennsylvania State Data Center. *Pennsylvania State and County Demographic Profiles* [Web Page]. Located at: <http://pasdc.hbg.psu.edu/>. Accessed 2003.
- Pennsylvania Department of Agriculture. 2003. *Pennsylvania's Equine Industry Inventory, Basic Economic and Demographic Characteristics*.
- Pennsylvania Department of Agriculture. *Data and Statistics, PA's Forest Products Industry* [Web Page]. Located at: <http://www.agriculture.state.pa.us/agriculture/cwp/view.asp?a=3&q=128901>. Accessed 2005 Nov 17.

- Pennsylvania Department of Conservation and Natural Resources. 2003. State Forest Resource Management Plan. Water Resources. [Web Page]. Located at: <http://www.dcnr.state.pa.us/forestry/sfrmp/water.htm>. Accessed 2007 Jan 11.
- Pennsylvania Department of Conservation and Natural Resources. 2003a. State Forest Resource management Plan, Silviculture/Timber Management [Web Page]. Located at: <http://www.dcnr.state.pa.us/forestry/sfrmp/silviculture.htm>. Accessed 2006 Feb 16.
- Pennsylvania Department of Conservation and Natural Resources. 2004. Pennsylvania's Outdoor Recreation Plan 2004-2008.
- Pennsylvania Department of Conservation and Natural Resources. Forest Health fact Sheet. Peach Bark Beetle [Web Page]. Located at: <http://www.dcnr.state.pa.us/forestry/leaflets/peachbark.htm>. Accessed 2005 Oct 13.
- Pennsylvania Department of Conservation and Natural Resources. 'Old Growth' Forest [Web Page]. Located at: <http://www.dcnr.state.pa.us/wlhabitat/forest/oldgrowth.htm>. Accessed 2006 Apr 2.
- Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry, Division of Forest Pest Management. 2005. Pennsylvania Annual Pest Conditions Report - 2005.
- Pennsylvania Department of Conservation and Natural Resources (PA-DCNR), Bureau of Forestry. 2005a. GIS coverage received from G. McPherson.
- Pennsylvania Department of Environmental Protection. 1985. Pennsylvania's Oil and Gas Act. Act 223, Title 58 Oil and Gas, Chapter 11 Oil and Gas Act.
- Pennsylvania Department of Environmental Protection. 1989. Pennsylvania Gazetteer of Streams. Harrisburg, Pennsylvania, USA .
- Pennsylvania Department of Environmental Protection. 2000. Erosion and Sediment Pollution Control Program Manual. Technical Guidance 363-2134-008. Bureau of Watershed Management.
- Pennsylvania Department of Environmental Protection. 2001. Pennsylvania Department of Environmental Protection. Title 25. Environmental Protection. Chapter 93. Water Quality Standards. Harrisburg, Pennsylvania, USA.
- Pennsylvania Department of Environmental Protection. Bureau of Water Supply and Wastewater Management. 2001a. Stream Redesignation Evaluation Report Water Quality Standards Review; Browns Run Warren County [Web Page]. Located at: <http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1261&q=450873>. Accessed 2007 Jan 11.
- Pennsylvania Department of Environmental Protection. 2002. Expert report - stream survey: Salmon Creek (55045); Little Salmon Creek (55092); Guiton Run (55093); Forest County, Meadville, PA.
- Pennsylvania Department of Environmental Protection. 2003. Water Quality Antidegradation Implementation Guidance. 391-0300-002. pp 1-17, 37-43, 68-70, 79-82, 109-121. Harrisburg, PA.
- Pennsylvania Department of Environmental Protection. 2004. 2004 Integrated Water Quality Monitoring and Assessment Report. Harrisburg, PA. pp 20-24,31-38 [Web Page]. Located at: <http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1261&q=480056>. Accessed 2005 Oct 27.
- Pennsylvania Department of Environmental Protection. 2005. Timber Harvest Operations Field Guide For Waterways, Wetlands and Erosion Control. Technical Guidance No. 3930-BK-DEP4016.
- Pennsylvania Department of Environmental Protection. Bureau of Water Supply and Wastewater Management. 2006. 2006 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 5 Water Bodies, Pollutants Requiring a TMDL. pp 471-473, 527, 566-567. Harrisburg, PA.
- Pennsylvania Department of Environmental Protection. Bureau of Water Supply and Wastewater Management. 2006a. Statewide Existing Use Classifications; Warren County. Harrisburg, PA.
- Pennsylvania Department of Transportation (PennDOT). 2001. Highway Statistics 2001, webbased.

- Pennsylvania Fish and Boat Commission. 1987. Pennsylvania's Clean Streams Law of 1937, as amended. P.L. 1987, Act 394, as amended (35 P.S. 691.1 et. seq.).
- Pennsylvania Forestry Association, in cooperation with the USDA Forest Service, Pennsylvania Hardwoods Development Council, PA DER Bureau of Forestry. undated. Penn's Woods Today. Mechanicsburg, PA .
- Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission. 2005. Pennsylvania Comprehensive Wildlife Conservation Strategy. Harrisburg, PA.
- Pennsylvania Game Commission. 1998. Considerations for Managing Old Growth Habitat for Wildlife Conservation (Draft). Harrisburg, PA.
- Pennsylvania Game Commission. 1999. Bald Eagle and Osprey Report, Northwest Region. Unpublished.
- Pennsylvania Game Commission. 2000. Bald Eagle and Osprey Report, Northwest Region. Unpublished report.
- Pennsylvania Game Commission. 2004. Bald Eagle and Osprey Report, Northwest Region.
- Pennsylvania State Data Center. Misc. web statistics including: 1. 1990 Census Profiles for Elk and Forest counties. 2. Municipal Socio-Economic Profiles for a. Elk County – Highland township, b. Elk County – Spring Creek township, c. Forest County – Jenks township, and d. Forest County – Howe township. 3. Municipal Demographic Profiles for a. Elk County – Highland township, b. Elk County – Spring Creek township, c. Forest County – Jenks township, and d. Forest County – Howe township [Web Page]. Located at: <http://pasdc.hbg.psu.edu/index.html>.
- Pennsylvania State Data Center. Census of Population and Housing, 1990,1980: Summary Tape File 1 and 3. Institute of State and Regional Affairs, Penn State Harrisburg, Middletown, PA [Web Page]. Located at: http://pasdc.hbg.psu.edu/pasdc/Data_&_Information/County_Profiles.html. Accessed 2001 Dec.
- Perala DA. 1977. Manager's Handbook for Aspen in the North Central States; Technical Report NE-36. USDA Forest Service.
- Perala DA. 1990. Silvics of North America Volume 2. Hardwoods-Quaking Aspen; Agriculture Handbook 654. USDA Forest Service.
- Perala DA, Russell J. 1983. Aspen. pp 113-115. In: Burns, R.M. 1983. Silvicultural Systems for the Major Forest Types of the United States; Agricultural Handbook No. 445. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Peterjohn WT, Mary Beth Adams, Frank S. Gilliam. 1996. Symptoms of nitrogen saturation in two central Appalachian hardwood forest ecosystems. Biogeochemistry (35):507-22.
- Peters P. 1978. Spacing of Roads and Landings to Minimize Timber Harvest Cost. Forest Science 24(2):209-17.
- Peterson CJ, S.T.A. Pickett. 1991. Treefall and Resprouting Following Catastrophic Windthrow in an Old-Growth Hemlock-Hardwood Forest. Forest Ecology Management (42):205-17.
- Phillips MJ, Lloyd W. Swift Jr, Charles R. Blinn . 2000. Best Management Practices for Riparian Areas. Ch. 16: 274-275 In: Elon S. Verry, James W. Hornbeck, and C. Andrew Dolloff, editors. Riparian Management in Forests of the Continental Eastern United States. Boca Raton, FL, USA: Lewis Publishers.
- Phippen SJ, E. Wohl. 2002. An assessment of land use and other factors affecting sediment loads in the Rio Puerco watershed, New Mexico. Geomorphology (52):269-87.
- Pimentel D, L. Lach, R. Zuniga, D. Morrison. 2000. Environmental and economic costs of nonindigenous species in the United States. Bioscience (50):53-65.
- Pitocchelli J. 1993. Mourning Warbler (*Oporornis philadelphia*). A. Poole and G. Gill editors. The Birds of North America. No 72. Philadelphia: Academy of Natural Sciences. Washington DC. American Ornithologists. Quoted In: R.M. DeGraaf and M. Yamasaki. 2001. New England Wildlife, Habitat, Natural History and Distribution. University Press of New England. 482 pp.
- Pomeroy JS. 1981. Landslides and related features Pennsylvania – Warren 1o x 2o sheet: U. S. Geological Survey Open-file Report 81-238, 112 plates, scale 1:24,000.

- Pomeroy JS. 1986. Slope Movements in the Warren-Allegheny Reservoir Area, Northwestern Pennsylvania. U. S. Geological Survey Bulletin 1650.
- Pough RH. 1949. Audubon bird guide: Eastern Land Birds. New York. Doubleday. 312 pp. Quoted In: R.M. DeGraaf and M. Yamasaki. 2001. New England Wildlife. Habitat, Natural History and Distribution. University Press of New England.
- Powers RF, D.H. Alban, R.E. Miller, A.E. Tiarks, C.G. Wells, P.E. Avers, R.G. Cline, R.O. Fitzgerald, N.S. Loftus Jr. 1990. Sustaining site productivity in North American Forests: Problems and Prospects. Proceedings of 7th North American Forest Soils Conference.
- Quinn AG, J.M. Adovasio. Unpublished. Test excavations at 36WA132, Allegheny National Forest. Erie, PA: Mercyhurst Archaeological Institute.
- Rawlins JE, C. W. Bier, C. W. Young, R. L. Davidson, S. A. Thompson, R. A. Androw. 1997. Study of Nocturnal Macrolepidoptera in Forest Ecosystems Associated with Population Outbreaks of the Elm Spanworm on the Allegheny National Forest, Pennsylvania. Carnegie Museum of Natural History and Western Pennsylvania Conservancy. Final Report.
- Rawlins JE, C. W. Bier, C. W. Young, R. L. Davidson, S. A. Thompson, R. A. Androw. 1998. Study of Nocturnal Macrolepidoptera, Sarcophagid Flies, and Carabid Beetles in Oak Habitats Historically Exposed to Pesticide Applications Targeted on the Gypsy Moth on the Allegheny National Forest, Pennsylvania. Carnegie Museum of Natural History and Western Pennsylvania Conservancy. Final Report.
- Reardon R, Hajek A. 1993. *Entomophaga maimaiga* in North America: A Review. NA-TP-15-93. U.S. Department of Agriculture, Forest Service, Northeastern Area, Forest Health Protection.
- Redding J. 1995. History of deer population trends and forest cutting on the Allegheny National Forest. Pages 214-224 in Proceedings of the Tenth Central Hardwood Conference. Edited by K.W. Gottschalk and S.L.C. Fosbroke. USDA Forest Service General Technical Report NE-197.
- Reineke, L. H. 1933. Perfecting a stand density index for even-aged forests. Journal of Agricultural Research 46(7):627-638
- Rhoads AF, W.M. Klein. 1993. The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas. Philadelphia, Pennsylvania, USA: American Philosophical Society.
- Ribe RG. 1989. The Aesthetics of Forestry: What has Empirical Preference Taught Us? Environ Manage 13(1):55-74.
- Richards C, Bob Hollingsworth. 2000. Managing Riparian Areas for Fish. Ch. 9: pp 162-163, 165-166 in Elon S. Verry, James W. Hornbeck, and C. Andrew Dolloff, editors. Riparian Management in Forests of the Continental Eastern United States. Boca Raton, FL, USA : Lewis Publishers.
- Riesenman JJr. 1943. History of Northwestern Pennsylvania, Volume II. NY,NY: Lewis Historical Publishing Company.
- Rink G. 1990. In Ostrey, M.E., Mielke, M.E., Skilling, D.D. 1994. Butternut-Strategies for Managing A Threatened Tree. St. Paul, MN: USDA. Forest Service, North Central Experiment Station. General Technical Report NC-165.
- Ristau TE, Horsley SB, Stout SL. 2005. Personal communication regarding "Impact of glyphosate and sulfometuron methyl on diversity of plants and wildlife in Allegheny hardwoods. Part I: Assessing impacts on understory plant communities." study.
- Ritchie WA, R.E. Funk. 1973. Aboriginal Settlement Patterns in the Northeast. New York State Museum Memoir 20.
- Ritchie WA. 1980. The Archaeology of New York State. Fleishmanns, New York, USA: Purple Mountain Press.
- Roach BA, Gingrich SF. 1968. Even-Aged Silviculture for Upland Central Hardwoods. Agriculture Handbook 355. Upper Darby, PA: USDA Forest Service, Northeastern Forest Experiment Station.
- Roach BA. 1972. Clearcutting in Hardwoods. Hotel John Marshall, Richmond, Virginia, January 25, 1972: Presented at the 29th Annual Meeting of Virginia Forests.

- Roach, BA. 1977. A stocking guide for Allegheny hardwoods and its use in controlling intermediate cuttings. USDA For. Serv. Res. Pap. NE-373, 30 p. Northeast. For. Exp. Stn., Broomall, Pa.
- Robbins CS, D. K. Dawson, B. A. Dowell. 1989. Habitat area requirements of breeding birds of the Middle Atlantic States. Wildlife Society Monograph. No. 103.
- Robbins CS, D. K. Dawson, B. A. Dowell. 1995. Habitat Area Requirements of Breeding Forest Birds of the Middle Atlantic States. Journal of Wildlife Management 103:1-34.
- Robbins MB, B.R. Barber, K. Zyskowski. 1998. Census of Cerulean Warblers along the upper Current River, with comments on the status of other riparian species. Bluebird. 65:10-16. Quoted In: P.B. Hamel. 2006. Adaptive Forest Management for Cerulean Warbler. Proceedings of Society of American Foresters National Convention. In press.
- Roberson, A.M., D.E. Anderson, and P.L. Kennedy. 2003. The northern goshawk, (*Accipiter gentiles atricapillus*) in the Western Great Lakes Region: a technical conservation assessment. Report for the Minnesota Fish and Wildlife Research Unit. 91 pp. Unpublished report.
- Robertson B, K.V. Rosenberg. 2001. Partner in flight (PIF) Landbird Conservation Plan. 2001. Physiographic Area 24: Allegheny Plateau. Version 1.0.
- Robinson CS, F. T. Lee, R. W. Moore, R. D. Carroll, H. Scott, J. D. Post, R. A. Bohman. 1972. Geological, geophysical and engineering investigations of the Loveland Basin landslide, Clear Creek County, Colorado; U.S. Geological Survey Professional Paper 673.
- Robinson SK. 1997. Effects of Different Kinds of Edges on Forest-Nesting Birds [abstract]. Session 19. Wildlife Society Annual Conference, September 1997. Where Do We Stand On Edges? Snowmass, Colorado, USA.
- Rodewald AD. 2004. Landscape and Local Influences of Forest Management on Cerulean Warblers in Pennsylvania. Quoted In: D.A. Yaussy, D.M. Long, R.P. Goebel. editors. Proceedings of the 14th Central Hardwoods Forest Conference. 2004 march 16-19. Wooster, OH. General Technical Report NE-316. Newtown Square, PA. U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 535 pp.
- Rodewald AD. 2006. Landscape and local influences of forest management on Cerulean Warbler in Pennsylvania. Proceedings of the 14th Annual Central Hardwood Forest Conference. March 16, 2004. GTR-NE-316. Newtown Square, PA.
- Rodewald RD, R.H. Yahner. 2001. Influence of landscape composition on avian community structure and associated mechanisms. Ecology 82(12):3493-504.
- Romme R, K. Tyrell, V. Brack Jr. 1995. Literature summary and habitat suitability Index Model: Components of summer habitat for the Indiana bat (*Myotis sodalis*). Cincinnati, Ohio, USA: 3D/Environmental.
- Rosenberg, et al. 2000. In Partner In Flight. 2001. Landbird Conservation Plan. Physiographic area 24. Allegheny plate a. Ithaca, New York: Cornell lab of ornithology.
- Rosenberg KV, S.E. Barker, R.W. Rohrbaugh. 2000. An Atlas of cerulean warbler populations: Final report to USFWS, 1997-2000 Breeding Seasons. Ithaca, NY: Cornell University.
- Rosenberg KV, S.E. Barker, R.W. Rohrbaugh. 2000a. An atlas of cerulean warbler populations: Final Report to USFWS, 1997-2000 Breeding Seasons. Ithaca, NY. Cornell University. Quoted In: Partners in Flight Landbird Conservation Plan for Physiographic Area 21: Allegheny Plateau. 2001. B. Robertson and K.V. Rosenberg editors.
- Ross P. 1996. Allegheny Oil: The Historic Petroleum Industry on the Allegheny National Forest. USDA Forest Service Eastern Region, Allegheny National Forest Heritage Publication No. 1.

- Ruffner CM, A. Sluyter, M.D. Abrams, C. Crothers, J. McLaughlin, R. Kandare. 1997. Assessing Native American disturbances in mixed-oak Forests of the Allegheny Plateau. Pages 96-103 in Proceedings, National Silviculture Workshop; General Technical Report NE-238. USDA Forest Service, Northeast Forest Experiment Station.
- Ruffner CM, Abrams M. unpublished. Historical Ecology of Allegheny Plateau Forests. 2000. 25 pp. Warren, PA: Submitted to Allegheny National Forest as part of Forest Plan Revision.
- Ruffner CM, Abrams MD. 2002. Dendrochronological investigation of disturbance history for a Native American site in northwestern Pennsylvania. *Journal of the Torrey Botanical Society* 129(3):251-60.
- Ruffner CM, Abrams MD. 2003. Disturbance History and Stand Dynamics along a Topographic Gradient in Old-Growth Hemlock-Northern Hardwood Forest of the Allegheny Plateau, USA. *Natural Areas Journal* 23(2):98-113.
- Runkle JR. 1982. Patterns of disturbance in some old-growth mesic forests of eastern North America. *Ecology* (63):1533-46.
- Runkle JR. 1985. Disturbance regimes in temperate forests. In: *The ecology of natural disturbance and patch dynamics*. New York: Academic Press.
- Runkle JR. 1991. Gap dynamics of old-growth eastern forests: Management implications. *Natural Areas Journal* (11):19-25.
- Sander ID, McGee CE, Day KG, Willard RE. 1983. Oak - Hickory. pp 116-120. In: Burns, R.M. 1983. *Silvicultural System for the Major Forest Types of the United States; Agricultural Handbook No. 445*. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Santillo DJ, D.M. Leslie Jr, P.W. Brown. 1988. Responses of small mammals and habitat to Glyphosate application on clearcuts. *Journal of Wildlife Management* (53):164-72.
- Sauer JR, J.E. Hines, J. Fallon. 2005. *The North American breeding bird survey. Results and Analysis 1966-2005. Versions 2005.2*. Laurel, MD: USGS Patuxent Wildlife Research Center.
- Schenk JS. 1887. *History of Warren County, Pennsylvania*. Syracuse, New York, USA: D. Mason & Company.
- Schreffler AM, W. E. Sharpe. 2003. Effects of lime, fertilizer, and herbicide on forest soil and soil solution chemistry, hardwood regeneration, and hardwood growth following shelterwood harvest. *Forest Ecology and Management* (177):471-84.
- Schuler TM. 2006. Crop Tree Release Improves Competitiveness of Northern Red Oak Growing in Association with Black Cherry. *Northern Journal of Applied Forestry* 23(2):77-82.
- Schultz M. 1999. One Terrible Week Three Fearsome Fires. *Wildland Firefighter* 2(9):30-5.
- Semlitsch RD, Bodie JR. 2003. Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibians and Reptiles. *Conservation Biology* 17(5):1219.
- SERA Syracuse Environmental Research Associates. 1996. *Selected Commercial Formulations of Glyphosate - Accord, Rodeo, Roundup, and Roundup Pro – Risk Assessment Final Report*.
- SERA Syracuse Environmental Research Associates. 1998. *Sulfometuron methyl (Oust) Final Draft Report*.
- Sevon WD, D. D. Braun. 2000. *Glacial Deposits of Pennsylvania*. Map 59. Harrisburg, PA: DCNR.
- Sevon WD, G. M. Fleeger. 1999. *Pennsylvania and the Ice Age*. 4th series. Harrisburg, PA: Pennsylvania Geological Survey, DCNR.
- Shaffer LL. 1991. *Pennsylvania Amphibians and Reptiles*. Harrisburg, Pennsylvania, USA: Pennsylvania Fish and Boat Commission.
- Sharpe WE, Drohan JR. 1999. Acidification status assessment of sensitive Pennsylvania forest soil. In: Sharpe, W.E. and J.R. Drohan, eds. *The Effects of Acidic Deposition on Pennsylvania's Forest*. Proceedings of the 1998 PA Acidic Deposition Conference. Vol. 1. pp 73-86. University Park, PA: Environmental Resources Research Institute.

- Sharpe WE, J.R.Drohan, editors. 1999. The Effects of Acidic Deposition on Pennsylvania's Forest. Proceedings of the 1998 PA Acidic Deposition Conference. Vol. 1. University Park, PA: Environmental Resources Research Institute.
- Sharpe WE, Halofsky JE. 2004. Hay-Scented Fern (*Dennstaedtia punctilobula*) and Sugar Maple (*Acer saccharum*) Seedling Occurrence with Varying Soil Acidity in Pennsylvania. In: Proceedings of the 14th Central Hardwood Forest Conference. March 16-19, 2004. GTR-NE-316. U.S. Department of Agriculture, Forest Service, Northeast Research Station.
- Shifflet, D.K. & Associates Ltd. 1997. DCNR Outdoor Traveler Study. McLean, VA.
- Shine R, Lemaster M, Wall M, Langkilde R, Mason R. 2004. Why did the snake cross the road? Effects of roads on movement and location of mates by garter snakes (*Thamnophis sirtalis parietalis*). Ecology and Society 9(1):9.
- Shultz CH, editor. 1999. The Geology of Pennsylvania. Lancaster, Pennsylvania, USA: Pennsylvania Geological Survey and Pittsburgh Geological Society.
- Simberloff D, J.A. Farr, J. Cox, D.W. Mehlman. 1992. Movement Corridors: Conservation Bargains or Poor Investments? Conservation Biology 6(4):493-504.
- Singer MT, C.G. Lorimer. 1997. Crown release as a potential old-growth restoration approach in northern hardwoods. Canadian Journal of Forest Research (27):1222-32.
- Siwicki RW. 2005. Water Resources Data for Pennsylvania, Water Year 2004, Volume 3, Ohio and St. Lawrence River Basins; USGS-WDR-PA-04-3. pp 54-55, 66-67, 94-95. U.S. Geological Survey, Water Resources Discipline.
- Smith DM. 1986. The Practice of Silviculture. Eighth ed. New York, New York, USA: John Wiley and Sons.
- Smith HC, Della-Bianca L, Fleming H. 1983. Appalachian Mixed Hardwoods. pp 141-144. In: Burns, R.M. 1983. Silvicultural Systems for the Major Forest Types of the United States; Agricultural Handbook No. 445. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Snow D. 1994. The Iroquois. Cambridge, Massachusetts, USA: Blackwell.
- Society of American Foresters, Silviculture Working Group. 1994. Silviculture terminology with appendix of draft ecosystem management terms. Bethesda, MD: Society of American Foresters.
- Solomon DS, W.B. Leak. 2000. Growth and Stocking of Eastern Hemlock (*Tsuga canadensis*) in New England. in McManus, K.A., and K.S. Shields, and D.R. Souto (eds.), Proceedings: Symposium on Sustainable Management of Hemlock Ecosystems in Eastern North America, June 22-24, 1999, Durham, New Hampshire. General Technician Report NE-267. Newtown Square, Pennsylvania: USDA, Forest Service Northeastern Research Station.
- Spies TA. 2004. Ecological concepts and diversity of old-growth forests. Journal of Forestry (102):14-20.
- Stage, A. R. 1968. A tree-by-tree measure of site utilization for grand fir related to stand density index. Res. Note INT-77. Ogden, UT: U. S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7p.
- Stein B, L. Kutner, J. Adams. 2000. Precious heritage: the status of biodiversity in the United States. New York, NY: Oxford University Press.
- Stewart M, J. Kratzer. 1989. Prehistoric site locations on the unglaciated Appalachian Plateau. Pennsylvania Archaeologist (59):19-36.
- Stoleson SH, L. Ordiway. 2003. Surveys for Yellow-bellied Flycatchers (*Empidonax flaviventris*) on the Allegheny National Forest, 2003. Irvine, PA: Northeastern Research Station.
- Stoleson SH. 2004. Cerulean Warbler Habitat Use in an Oak-Northern Hardwood Transition Zone: Implications for Management. Proceedings of the 14th Central Hardwoods Forest Conference.
- Stoleson SH. 2004. Cerulean Warbler habitat use in an oak-northern hardwoods transition zone: implications for management. Quoted In: Daniel A. Yaussy, D.M. Hix, R.P. Long and P.C. Goebbel editors. Proceedings of the 14th Central hardwoods Forest Conference. March 16-19, 2004. Wooster, OH. General Technical Report NE-316. Newtown Square, PA. U.S. Department of Agriculture, Northeastern Research Station.

- Stoleson S. 2004. personal communication. Progress report for impact of glyphosate and sulfometuron methyl on diversity of plants and wildlife in allegheny hardwoods.
- Stoleson SH. 2005. Personal communication regarding Impact of Glyphosate and Sulfometuron on Diversity of Plants and Wildlife in Allegheny Hardwoods: Responses of Wildlife Communities to Herbicide Application.
- Stoleson S. 2005a. personal communication. Memo pertaining to Forest Cerulean Warbler surveys and canopy closure.
- Stoleson S. 2006. personal communication. Memo pertaining to mourning warbler densities in shelterwoods.
- Stone RB. 1926. McKean: The Governor's County. New York, New York, USA: Lewis Historical Publishing Company.
- Stout SL. 1994. Principles and practices of uneven-age management. Pages 329-366 in Quantitative silviculture for hardwood forests of the Alleghenies. Marquis, David A., editor; General Technical Report NE-183USDA Forest Service Northeastern Forest Experiment Station.
- Stout S. 2006. Electronic communication. Background concerning studies east of forest road 116.
- Stransky JJ, J.H. Rose. 1984. Promoting Soft Mast for Wildlife in Intensively Managed Forests. Quoted In: USDA-FS 2000. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional uses and New Directions, Proceedings of a Special Workshop. Nashville TN. General Technical Report NE-288.
- Strauss CH, B.E. Lord, M.J. Powell, M. Shields, T.W. Kelsey. 2000. Economic Impact of Pennsylvania's Hardwood Industry: Current Status and Proposed Growth. Unpublished report. University Park, Pennsylvania, USA: College of Agricultural Sciences, The Pennsylvania State University.
- Strauss CH, Lord BE, Powell MJ. 2004. Economic Impact of the Wood Industry in the AHUG Region. University Park, PA: School of Forest Resources, The Pennsylvania State University.
- Stuart GW, Edwards PJ. 2006. Concepts about Forests and Water. Northern Journal of Applied Forestry 23(1):11-9.
- Stuart WB, J. L. Carr. 1991. Harvesting Impacts on Steep Slopes in Virginia. Pages 67-81 in Proceedings of the 8th Central Hardwood Conference; 1991 March 4-6; PA; General Technical Report NE-148. USDA Forest Service Northeastern Forest Experiment Station.
- Stynes DJ, White EM. 2005. Spending Profiles of National Forest Visitors, NVUM Four Year Report. U.S. Department of Agriculture, Forest Service and Michigan State University.
- Sutherland S. 2004. First Order Fire Effects Model (FOFEM) . Version 5.0. Rocky Mountain Research Station, Missoula Fire Laboratory.
- Swift LWJr. 1984. Gravel and grass surfacing reduces soil loss from mountain roads. Forest Science 30(3):657-70.
- Swift LWJr. 1988. Forest access roads: design, maintenance, and soil loss. Pages 313-324 in Swank, W. T., and D. A. Crossley, Jr. editors. Forest hydrology and ecology at Coweeta. Ecological Studies, Volume 66. New York, New York, USA: Springer-Verlag.
- Swistock BR, D.R. DeWalle, S.B. Horsley, R.P. Long, T.J. Hall, S. Bailey. 1999. Soil water chemistry in declining and non-declining sugar maple stands. In: The Effects of Acidic Deposition on Pennsylvania's Forests. Proceedings of the 1998 PA Acidic Deposition Conference, Vol 1. University Park, PA: Environmental Resources Research Institute.
- Syracuse Environmental Research Associates, Inc. (SERA). 1997. Effects of Surfactants on the Toxicity of Glyphosate, With Specific Reference to RODEO [Web Page]. Located at: http://www.fs.fed.us/foresthealth/pesticide/risk_assessments/Surfactants.pdf. Accessed 2007 Jan 11.
- Syracuse Environmental Research Associates, Inc. (SERA). 2003. Glyphosate - Human Health and Ecological Risk Assessment, Final Report [Web Page]. Located at: http://www.fs.fed.us/foresthealth/pesticide/risk_assessments/04a03_glyphosate.pdf. Accessed 2007 Jan 11.

- Syracuse Environmental Research Associates, Inc. (SERA). 2004. Sulfometuron Methyl - Human Health and Ecological Risk Assessment - Final Report [Web Page]. Located at: http://www.fs.fed.us/foresthealth/pesticide/risk_assessments/121404_Sulfometuron.pdf. Accessed 2007 Jan 11.
- Taber TTI. 1974. Logging Railroad Era of Lumbering in Pennsylvania, Vol. 10. Tanbark, Alcohol, and Lumber. Williamsport, Pennsylvania, USA: Lycoming Printing Company.
- Taber TTI. 1975. Logging Era of Lumbering in Pennsylvania, Vol. 7. Sawmills Among the Derricks. Williamsport, Pennsylvania, USA: Lycoming Printing Company.
- Tamm CO. 1991. Nitrogen in Terrestrial Ecosystems: Questions of productivity, vegetational changes, and ecosystem stability. New York: Springer-Verlag.
- Tatum VI. 2004. Toxicity transport and fate of forest herbicides. *Wildlife Society Bulletin*. 32:1042-1048. Quoted In: Wildlife Society. 2004. The role of herbicides for enhancing forest productivity and conserving land for biodiversity in North America. *Wildlife Society Bulletin*. 32:1049-1060.
- Taylor DL. 1981. Wildlife considerations in prescribed fire in national parks. Quoted In: USDA-FS. 2000. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions, Proceedings of a Special Workshop. Nashville, TN. General Technical Report NE-288.
- Teck, Richard M.; Hilt, Donald E. 1990. Individual-tree probability of survival model for the Northeastern United States Res. Rep. NE-642. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 10 pp.
- Teck, Richard M.; Hilt, Donald E. 1991. Individual tree-diameter growth model for the Northeastern United States Res. Pap. NE-649. Radnor, PA: US. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 11 pp.
- Ternet MA. 2003. Biology, Status and Management of Black Bear in Pennsylvania. Stakeholder advisory committee meeting. Pennsylvania Game Commission.
- Thompson FR, R.M. DeGraaf, M.K. Trani. 2001. Conservation of Woody, Early Successional Habitats and Wildlife in the Eastern United States. *Wildlife Society Bulletin* 29(2):407-94.
- Thompson MA, J. A. Mattson, J. B. Sturos. 1997. Methods Used to Evaluate the Effects of Forest Operations on the Remaining Vegetation and Soil: Review and Recommendations. Pages 62-75. In: Proceedings: Forest Operations for Sustainable Forests and Healthy Economics. USDA Forest Service- South Dakota State University.
- Tilghman NG. 1989. Impacts of the white-tailed deer on forest regeneration in northwestern Pennsylvania. *Journal of Wildlife Management* (53):524-32.
- Trieu P. 1999. Assessment of physiochemical and biological effects of two types of road surface on adjacent roads. Thesis. State College, Pennsylvania, USA: Pennsylvania State University.
- Trimble GR. 1970. 20 Years of Intensive Uneven-Aged management: Effect on Growth, Yield, and Species Composition in Two Hardwood Stands in West Virginia. Research Paper NE-154. Upper Darby, PA: USDA Forest Service, Northeastern Forest Experiment Station.
- Trombulak SC, C.A. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. *Conservation Biology* (8):18-30.
- Trombulak SK. 1996. The Restoration of Old Growth: Why and How. pp. 305-320. In Davis, M.B. (ed.), Eastern Old Growth Forests, Prospects for Rediscovery and Recovery. Washington D.C.: Island Press.
- Tu M, Hurd C, Randall JM. 2001. Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas The Nature Conservancy.
- Tubbs CH. 1977. Natural Regeneration of Northern Hardwoods in the Northern Great Lakes Region. Research Paper NC-150. St. Paul, Minnesota: USDA Forest Service, North Central Forest Experiment Station.

- Tubbs CH, Jacobs RD, Cutler D. 1983. Northern Hardwoods. pp 121-127. In: Burns, R.M. 1983. Silvicultural System for the Major Forest Types of the United States; Agriculture Handbook No. 445. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Tucker J. 1992. Managing natural rather than artificially increased diversity: early successional birds of the White Mountain National Forest. Thesis. Durham, New Hampshire: University of New Hampshire.
- Turner G. 2005. Ecology of the flying squirrel in Pennsylvania. Presentation at the Pennsylvania Chapter of the Wildlife Society 2005 Annual Conference and Workshop: Conservation Planning for Wildlife in Pennsylvania.
- Twedt DJ, C.R. Loesch. 1999. Forest Area and Distribution in the Mississippi Alluvial Valley: Implications for Breeding Bird Conservation. *Journal of Biogeography* 20:100-10.
- Twedt DJ, W.B. Uihlein III, A.B. Elliott. 2006. Habitat restoration for forest bird conservation: A spatially explicit decision support model. *Conservation Biology*. 20:100-110. Quoted In: P.B. Hamel. 2006. Adaptive Forest Management for Cerulean Warbler, Proceedings of Society of American Forester national Convention. in press.
- Tyrrell LE. 1996. National Forests in the Eastern Region: Land Allocation and Planning for Old Growth. pp. 245-273. In Davis, M.B. (ed.), Eastern Old Growth Forests, Prospects for Rediscovery and Recovery. Washington D.C.: Island Press.
- U.S. Congress, Office of Technology Assessment. 1993. Harmful Non-Indigenous Species in the United States, OTA-F-565. Washington, D.C.: U.S. Congress, Office of Technology Assessment.
- U.S. Department of Agriculture APHIS. Asian Longhorned Beetle - Chronology [Web Page]. Located at: <http://www.aphis.usda.gov/ppq/ep/alb/chron-2000-pres.html>. Accessed 2007 Jan 11.
- U.S. Department of Agriculture APHIS. Asian Longhorned Beetle - Chronology 1996-1999 [Web Page]. Located at: <http://www.aphis.usda.gov/ppq/ep/alb/chron-96-99.html>. Accessed 2007 Jan 11.
- U.S. Department of Agriculture, Forest Service. 1974. Agriculture Handbook 462. National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System.
- U.S. Department of Agriculture, Forest Service. 1977. Timber Management Plan, Region 9, Allegheny National Forest, October 1977 to September 1984. U.S. Department of Agriculture, Forest Service, Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1983. Silvicultural systems for the major forest types of the United States. Agricultural Handbook No. 445.
- U.S. Department of Agriculture, Forest Service. 1985a. A Twenty-year History of Forest Insect and Disease Management on the Allegheny National Forest, Pennsylvania, 1965-1985. Morgantown, WV: Forest Pest Mgmt., USDA-FS.
- U.S. Department of Agriculture, Forest Service. 1986a. Allegheny National Forest Final Environmental Impact Statement Land and Resource Management Plan (FEIS). Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1986b. Allegheny National Forest Land and Resource Management Plan. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1986c. Allegheny National Forest Record of Decision Final Environmental Impact Statement Land and Resource Management Plan. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1986d. Integrating Recreation with other Resource (Bev Driver script). 1986 ROS Book. pp IV 27-35.
- U.S. Department of Agriculture, Forest Service. 1986f. Allegheny National Forest Appendix B Final Environmental Impact Statement Land and Resource Management Plan. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1988. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1987. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1989. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1988. Warren, Pennsylvania, USA.

- U.S. Department of Agriculture, Forest Service. 1989a. Environmental Analysis for the Use of Herbicides to Control Undesirable Vegetation in Forested Stands. Bradford Ranger District, Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1989b. Final EIS, Appalachian Integrated Pest Management (AIPM), Gypsy Moth Demonstration Project; Mgmt. Bull. R8-MB 33. Morgantown, WV.
- U.S. Department of Agriculture, Forest Service. 1989c. Final Environmental Impact Statement, Vegetation Management in the Coastal Plain/Piedmont, Volume I. January 1989. Atlanta, Georgia, USA: Southern Region.
- U.S. Department of Agriculture, Forest Service. 1989d. Final Environmental Impact Statement, Vegetation Management in the Coastal Plain/Piedmont, Appendices, Volume II. January 1989. Atlanta, Georgia, USA: Southern Region.
- U.S. Department of Agriculture, Forest Service. 1989e. Fragmentation Model, Mount Hood National Forest, December 1989. Fragmentation Task Force: T. Hussey, B. Knott, D. Zalundardo, R. McNair. Sandy, Oregon.
- U.S. Department of Agriculture, Forest Service. 1990. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1989. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1990a. Economic Considerations of Surfacing Materials on the ANF. Unpublished report. Warren, Pennsylvania, USA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1990b. Road and Landing Spacing on the Allegheny National Forest, unpublished report. Warren, Pennsylvania, USA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1991. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1990. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1991a. Final Environmental Impact Statement and Record of Decision for Understory Vegetation Management on the Allegheny National Forest. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1991b. Decision memo for aerial fertilization on the Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1992. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1991. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1992a. Summary of Responses to Project or IPS Appeal Points Relating to Herbicide Use - for Environmental Assessments completed August through November 1992. Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1992b. Prescribing Silvicultural Treatments in Hardwood Stands of the Alleghenies (Revised); General Technical Report NE-96. Northeastern Forest Experiment Station.
- U.S. Department of Agriculture, Forest Service. 1992c. Letter from Allegheny National Forest supervisor to appellants RE: Appeal #92-09-19-025 (1992 Herbicide Project, Bradford Ranger District), signed by T.E. Beauvais, 8/19/92. On File at the Bradford Ranger District Office.
- U.S. Department of Agriculture, Forest Service. 1992d. Deer Management on the Allegheny National Forest. Unpublished report.
- U.S. Department of Agriculture, Forest Service. 1993. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1992. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1994. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1993. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1994a. Ecological Subregions of the United States: Section Descriptions. Washington DC. W. H. McNab and P. E. Avers; ECOMAP. July 1994.
- U.S. Department of Agriculture, Forest Service. 1994b. Quantitative Silviculture for Hardwood Forests of the Alleghenies; General Technical Report NE-183. Northeastern Forest Experiment Station.

- U.S. Department of Agriculture, Forest Service. 1994c. Forest Service Handbook. FSH 7709.56b – Transportation Structures Handbook. Amendment No. 7709.56b-94-1, July 27, 1994. Washington, D.C., USA.
- U.S. Department of Agriculture, Forest Service. 1995. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1994. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1995a. Analysis of Timber Harvest Program Capability. Warren, Pennsylvania, USA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1995b. Shifts in Stocking Reveal Forest Health Problems; NA-TP-07-95. Radnor, PA: The Northeastern Forest Experiment Station.
- U.S. Department of Agriculture, Forest Service. 1995c. Map Unit Tables Subsections Ecological Units of the Eastern United States First Approximation 1995. 83p plus map.
- U.S. Department of Agriculture, Forest Service. 1995d. A Landscape Corridor Approach to Providing Late-Successional Forests and Associated Functions and Values on the Allegheny National Forest. Unpublished.
- U.S. Department of Agriculture, Forest Service. 1995e. Landscape Aesthetics: a Handbook for Scenery Management, WO, FS Handbook HB701.
- U.S. Department of Agriculture, Forest Service. 1995f. The Forest Service Program for Forest and Rangeland Resources: A Long-Term Plan. Draft RPA Program.
- U.S. Department of Agriculture, Forest Service. 1995g. Forest Health through Silviculture. Proceedings of the 1995 National Silviculture Workshop. General Technical Report RM-GTR-267. Mescalero, New Mexico, USA.
- U.S. Department of Agriculture, Forest Service. 1995h. Environmental Assessment of Tree Mortality and Ecosystem Sustainability on the Allegheny National Forest. Warren Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1995i. Description of the Ecoregions of the United States. Misc. Publication Number 1391. 108 pp plus map.
- U.S. Department of Agriculture, Forest Service. 1996. Allegheny National Forest Annual Monitoring Report for Fiscal Year 1995. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1996a. Draft uneven-aged management guidelines for the ANF.
- U.S. Department of Agriculture, Forest Service. 1996b. Riparian Ecosystem Guide for the Allegheny National Forest. Draft, Unpublished.
- U.S. Department of Agriculture, Forest Service. 1996c. Horse Use and Associated Impacts on the Allegheny National Forest. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1996d. Fish and Wildlife Monitoring and Evaluation Report. 1996. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1997. Allegheny National Forest Annual Monitoring Report for Fiscal Year 1996. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1997b. Fisheries Amendment to the Allegheny National Forest, Land and Resource Management Plan. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1997c. Allegheny National Forest Final Environmental Impact Statement for Vegetation Management on Electric Utility Rights-of-way. Warren, Pennsylvania, USA : Environmental Consultants Incorporated.
- U.S. Department of Agriculture, Forest Service. 1997d. Allegheny National Forest Compartment Prescription Handbook, draft.
- U.S. Department of Agriculture, Forest Service. 1998. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1997. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1998a. Timber Sale Program Information Reporting System, Fiscal Year 1997. Warren, PA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1998b. Stemming the Invasive Tide: Forest Service Strategy for Noxious and Nonnative Plant Management.

- U.S. Department of Agriculture, Forest Service. 1998c. Region 9-Riparian Area Definition and Management. FSM 2500 - Watershed Protection And Management R9 Supplement 2500-98-1; Chapter 20 - Watershed Protection And Management; Effective 10/21/1998.
- U.S. Department of Agriculture, Forest Service. 1998d. Recreation Use Report. Unpublished report (spreadsheet). Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 1998e. Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings. San Dimas, California, USA: San Dimas Technology and Development Center.
- U.S. Department of Agriculture, Forest Service. 1998f. Charting Our Future...A Nation's Natural Resource Legacy. FS-630.
- U.S. Department of Agriculture, Forest Service. 1998g. Biological Assessment For Threatened and Endangered Species on the Allegheny National Forest. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 1998h. The Natural Resource Agenda. Washington DC: U.S. Department of Agriculture, Forest Service.
- U.S. Department of Agriculture, Forest Service. 1999. Correspondence from Janice H. McDougale, Acting Deputy Chief for State and Private Forestry, to Regional Forester, Region 3, regarding public comments providing additional information on pesticides. Washington, DC, USA.
- U.S. Department of Agriculture, Forest Service. 1999a. Sustaining Recruitment of Oak Reproduction in Uneven-aged Stands in the Ozark Highlands; General Technical Report NC-203. North Central Research Station.
- U.S. Department of Agriculture, Forest Service. 1999b. Road Analysis: Informing decisions about managing the National Forest Transportation System. Misc. Rep. FS-643. Washington, D.C.: USDA Forest Service.
- U.S. Department of Agriculture, Forest Service. 1999c. Public Comments Providing Additional Information on Pesticides. USDA Forest Service Washington Office Memo.
- U.S. Department of Agriculture, Forest Service. 1999d. Early Successional Habitat and Open Lands Assessment. The Eastern and Southern Regions. Report 1.
- U.S. Department of Agriculture, Forest Service. 2000. Allegheny National Forest Fish and Wildlife Management Indicator Species Monitoring Report. Report for Fiscal Years 1986-2000. March, 2000. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 2000a. Roads, Self Study Training Course, Construction Certification Program. July, 2000.
- U.S. Department of Agriculture, Forest Service. 2000b. Roads Analysis, Lower Steamboat Watershed, North Umpqua Ranger District, October, 2000.
- U.S. Department of Agriculture, Forest Service. 2000c. Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2 – Maps of Inventoried Roadless Areas; Washington Office, November 2000.
- U.S. Department of Agriculture, Forest Service. 2000e. Fish and Wildlife Management Indicator Species Monitoring Report for Fiscal Years 1986 - 1999. Allegheny National Forest. Warren, Pennsylvania, USA .
- U.S. Department of Agriculture, Forest Service. 2000f. Final Environmental Impact Statement for Threatened and Endangered Species on the Allegheny National Forest. Warren, Pennsylvania, USA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2000g. East Side Final Environmental Impact Statement. Allegheny National Forest. Warren, Pennsylvania, USA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2000h. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1998. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 2000i. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Direction, Proceedings of a Special Workshop. Nashville, TN. General Technical Report NE-288. U.S. Department of Agriculture, Forest Service, Northeastern Research Station.

- U.S. Department of Agriculture, Forest Service, 2001, "The Built Environment Image Guide" FS-710.
- U.S. Department of Agriculture, Forest Service. 2001a. Re-evaluation of ANF Soils Monitoring Data for FY 1990-FY 2000. August 7.
- U.S. Department of Agriculture, Forest Service. 2001b. National Strategy for Special Forest Products, FS-713.
- U.S. Department of Agriculture, Forest Service. 2001c. Duck Creek/Swains Roads Analysis.
- U.S. Department of Agriculture, Forest Service. 2001d. Allegheny National Forest Monitoring and Evaluation Report - Fiscal Year 1999. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 2001e. Allegheny National Forest Bradford Ranger District, Roads Analysis Report, Lewis Run Project – 2001, Version 1.0.
- U.S. Department of Agriculture, Forest Service. 2001f. Draft Watershed Integrity Ranking for the Allegheny National Forest. Warren, PA.
- U.S. Department of Agriculture, Forest Service and The University of Tennessee, Knoxville TN. 2001g. 1999-2000 National Survey on Recreation and the Environment.
- U.S. Department of Agriculture, Forest Service. 2002. Allegheny National Forest Monitoring and Evaluation Report-Fiscal Year 2000. Warren, Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 2002a. Spring Creek Roads Analysis Report. Version 1.0. Allegheny National Forest, Marienville Ranger District.
- U.S. Department of Agriculture, Forest Service. 2002b. National Visitor use Monitoring Results, unpublished data.
- U.S. Department of Agriculture, Forest Service. 2002c. Managing Degraded Off-Highway Vehicle Trails in Wet, Unstable, and Sensitive Environments. Missoula, Montana, USA.
- U.S. Department of Agriculture, Forest Service. 2002d. Forest Service Handbook, Soil Management, Chapter 2 – Soil Quality Monitoring; Region 9 interim directive.
- U.S. Department of Agriculture, Forest Service. 2002e. County Line – Fourmile Roads Analysis Report. Warren, Pennsylvania, USA: Bradford District, Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2002f. Conservation Assessment for Cerulean Warbler. Compiled by D.E. Burhans for USDA Forest Service Eastern Region. Milwaukee, Wisconsin.
- U.S. Department of Agriculture, Forest Service. 2002g. Pest Alert, Sudden Oak Death. NA-PR-02-02. U.S. Department of Agriculture, Forest Service, State and Private Forestry, Northeastern Area.
- U.S. Department of Agriculture, Forest Service. 2002h. Buffer strip effectiveness monitoring for water quality during and after herbicide application. Warren, PA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2003. 2003 Storm Assessment, Addendum B. Warren, PA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2003a. Sugar Run Project, Appendix D, Biological Assessment. Warren, PA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2003b. Allegheny National Forest Forest-wide Roads Analysis: Version 1.0. Warren Pennsylvania, USA.
- U.S. Department of Agriculture, Forest Service. 2003c. Sugar Run Draft Environmental Impact Statement. Warren, Pennsylvania, USA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2003d. Spring Creek Project Roads Analysis Report. Version 1.0. Allegheny National Forest, Marienville Ranger District.
- U.S. Department of Agriculture, Forest Service. 2003e. Spring Creek Ecosystem Analysis at the Watershed Scale (EAWS). Allegheny National Forest, Marienville Ranger District.
- U.S. Department of Agriculture, Forest Service. 2003f. Prescribed Burn Project Environmental Assessment. Bradford, Pennsylvania, USA: Bradford Ranger District, Allegheny National Forest.

- U.S. Department of Agriculture, Forest Service. 2003g. Endangered and Threatened Species Monitoring on the Allegheny National Forest. FY 2002. Compliance with the Terms and Conditions in the Biological Opinion. Warren, PA: USDA Forest Service.
- U.S. Department of Agriculture, Forest Service. 2004a. Allegheny National Forest. 2003 Storm Assessment Addendum.
- U.S. Department of Agriculture, Forest Service. 2004b. 2004 Hemlock Woolly Adelgid Survey Results. Northeastern Area, State and Private Forestry.
- U.S. Department of Agriculture, Forest Service. 2004c. Allegheny National Forest Monitoring and Evaluation Report – Fiscal Year 2001. Warren, PA.
- U.S. Department of Agriculture, Forest Service. 2004d. Martin Run Roads Analysis: Version 1.0. page 16. Marienville PA.
- U.S. Department of Agriculture, Forest Service. 2004e. The State of the Forest: A Snapshot of Pennsylvania's Updated Forest Inventory 2004: NA-FR-03-04. USDA Forest Service.
- U.S. Department of Agriculture, Forest Service. 2004f. Sudden Oak Death, Protecting America's Woodlands from *Phytophthora ramorum*. FS-794. USDA Forest Service.
- U.S. Department of Agriculture, Forest Service. 2004g. FR 127 Implementation Monitoring Review - 8/24/2004 . Warren, PA: Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service. 2004h. Pest Alert, Asian Longhorned Beetle (*Anoplophora glabripennis*): A New Introduction. NA-PR-01-99GEN. U.S. Department of Agriculture, Forest Service, Animal and Plant Health Inspection Service.
- U.S. Department of Agriculture, Forest Service. 2005. A compilation of Species Viability Evaluation Data Collection Forms for the Allegheny National Forest. Warren, PA: Allegheny National Forest Supervisor's Office.
- U.S. Department of Agriculture, Forest Service. 2005a. Forest Service Handbook, Soil Management, Chapter 2 – Soil Quality Monitoring; Region 9 supplement. Supplement Number R9RO 2509.18-2005-1. U.S. Department of Agriculture, Forest Service.
- U.S. Department of Agriculture, Forest Service. 2005b. Forest Inventory and Analysis National Core Field Guide. Volume 1: Field Data Collection Procedures for Phase 2 plots. Version 3.0. Northeast Edition. pp 119-126. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station.
- U.S. Department of Agriculture, Forest Service. 2006. Ecological Context for the Allegheny National Forest. 162 pp.
- U.S. Department of Agriculture, Forest Service. unpublished. Allegheny National Forest NVUM Survey Data 2000-2001.
- U.S. Department of Agriculture, Forest Service. unpublished. Strategic Plan. Four Threats to the Health of the Nation's Forests and Grasslands.
- U.S. Department of Agriculture, Forest Service, Allegheny National Forest. 1991. Final Environmental Impact Statement. Understory Vegetation Management. Warren, PA: USDA Forest Service, Allegheny National Forest.
- U.S. Department of Agriculture, Forest Service, Allegheny National Forest. 2000. Final Environmental Impact Statement for the East Side Project, Appendix F. Warren, PA: USDA Forest Service, Allegheny National Forest.
- U.S. Department of Agriculture Forest Service, Allegheny National Forest. unpublished. Draft Document. Results of 1996 Uneven-aged Management Survey. November 1997.
- U.S. Department of Agriculture, Forest Service, Allegheny National Forest, The Pennsylvania State Historic Preservation Officer, The Advisory Council on Historic Preservation. 2005. Programmatic Agreement regarding the process for compliance with section 106 of the national historic preservation act for undertakings on the Allegheny National Forest of the eastern region of the USDA forest service.
- U.S. Department of Agriculture, Forest Service and the University of Tennessee, Knoxville, Tennessee. unpublished. 1999-2000 National Survey on Recreation and the Environment.

- U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station . unpublished. Forest Statistics for the Allegheny National Forest - 1989.
- U.S. Department of Commerce, Bureau of Economic Analysis. Various data tables profiling economic and demographic summaries at varying levels of intensity [Web Page]. Located at: <http://bea.gov>. Accessed 2006 Feb.
- U.S. Department of Interior, Fish and Wildlife Service. 1977. National Wetlands Inventory prepared by Office of Biological Services for the National Wetlands Inventory. Newton Corner, MA 01258.
- U.S. Department of Interior, Fish and Wildlife Service. 1992. Revised Small Whorled Pogonia (*Isotria medeoloides*) Recovery Plan. Concord, New Hampshire.
- U.S. Department of Interior, Fish and Wildlife Service. 1999. Biological Opinion on the Impacts of Forest Management and Other Activities to the Bald Eagle, Indiana Bat, Clubshell and Northern Riffleshell on the Allegheny National Forest.
- U.S. Department of Interior, Fish and Wildlife Service. 2000. Correspondence from David Densmore, Supervisor, to John Palmer, Forest Supervisor, Allegheny National Forest amending Biological Opinion on the Impacts of Forest Management and Other Activities to the Bald Eagle, Indiana Bat, Clubshell and Northern Riffleshell on the ANF. State College, Pennsylvania, USA.
- U.S. Department of Interior, Fish and Wildlife Service. 2002. Letter from Director, Fish and Wildlife Service to Regional Directors, Subject: Alternative Approaches for Streamlining Section 7 Consultation on Hazardous Fuels Treatment Projects.
- U.S. Department of Interior, Fish and Wildlife Service. 2005a. Avian Protection Plan Guidelines. A joint document prepared by The Edison Electric Institute's Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service. 83 pp.
- U.S. Department of Interior, National Park Service. 1982. North Country National Scenic Trail Comprehensive Plan for Management and Use.
- U.S. Geological Survey. 2000. A survey of freshwater mussel populations at West Hickory Bridge Alternative 2 and 3 on the Allegheny River, MP 158.9, State Rt. 0127, Section B00, Forest Co., PA. A report submitted to PennDOT, District 1-0 Oil City, PA. Kearneysville, WV: Leetown Science Center.
- United States Environmental Protection Agency. 1997. Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines. EPA420-F-97-014. Air and radiation.
- United States Environmental Protection Agency. 2003. Emissions & Generation Resource Integrated Database. eGRID Version 2.01 [electronic database]. 2003. 2002 Emissions Data. Environmental Protection Agency.
- United States Environmental Protection Agency. 2004. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition. EPA420-P-04-009. Assessment and Standards Division, Office of Transportation and Air Quality.
- United States Environmental Protection Agency. 2004a. Exhaust Emission Factors for Nonroad Engine Modeling - Spark Ignition. EPA420-P-04-010. Assessment and Standards Division, Office of Transportation and Air Quality.
- United States Environmental Protection Agency. 2005. Green Book [Web Page]. Located at: <http://www.epa.gov/oar/oaqps/greenbk>. Accessed 2005 Sep 29.
- United States Environmental Protection Agency, Assessment and Standards Division, Office of Transportation and Air Quality. 2002. Frequently Asked Questions from ATV Riders. EPA420-F-02-038.
- United States Environmental Protection Agency Office of Air and Radiation Clean Air Markets Division. 2003. Acid Rain Program 2002 Progress Report." EPA Publication EPA-430-R-03-001. Washington DC.
- Urban C. 2005. The Timber Rattlesnake: Pennsylvania's Uncanny Mountain Denizen.

- Urban DL, et al. 1987. In Chambers, Carol L. et. al. 1995. Linking Reserve Areas: Using Animal Responses to Silvicultural Systems as Models for Management for Management. Corvallis, Oregon. Pages 9-17. In: Sustainable Society and Protected Areas in Proceedings of the 8th Conference on Research and Resource Management in Parks and on Public Lands. April 17-21, 1995.
- Van Breemen N, P.A. Burrough, E.J. Velthorst, H.F. van Dobben, Toke de Wit, T.B. Ridder, H.F.R. Rijnders. 1982. Soil acidification from atmospheric ammonium sulphate in forest canopy throughfall. *Nature* (299):548-50.
- Van Dorp D, P.F.M. Opdam. 1987. In Davidson, C. 1998. Issues in Measuring Landscape Fragmentation. *Wildlife Society Bulletin* (26):32-7.
- Vannote RL, G.W. Minshall, K.W. Cummins, J.R. Sedell, C.E. Cushing. 1980. The River Continuum Concept. *Canadian Journal of Fisheries Aquatic Science* (37):130-6.
- Vaughan DM. 2002. Potential Impact of Road-Stream Crossings (Culverts) on the Upstream Passage of Aquatic Macroinvertebrates. Portland, Oregon: The Xerces Society; Report submitted to the U.S. Forest Service, San Dimas Technology and Development Center.
- Verry ES, J. W. Hornbeck, C. A. Dollof. 2000. Riparian Management in Forests of the Continental Eastern United States. Boca Raton: Lewis Publisher.
- Villella RF, Smith DR. 2002. A survey of the freshwater mussel populations at Hunter Station on the Allegheny River. USGS, Biological Resource Division, Leetown Science Center/Aquatic Ecology Laboratory.
- von Oettingen SL. 1992. Small Whorled Pogonia Recovery Plan First Revision. Newton Corner, Mass: USFWS.
- Vora RS. 1994. Integrating old-growth forest into managed landscapes: A northern Great Lakes perspective. *Natural Areas Journal* (14):113-23.
- Wall MA, Timmerman-Erskine M, Boyd RS. 2003. Conservation Impact of Climatic Variability on Pollination of the Federally Endangered Plant, *Clematis socialis* (Ranunculaceae). *Southeastern Naturalist* 2(2):11-24.
- Wallace AFC. 1969. The Death and Rebirth of the Seneca. New York, New York, USA: Random House.
- Wallace PAW. 1981. Indians in Pennsylvania. Harrisburg, Pennsylvania, USA: Commonwealth of Pennsylvania, Pennsylvania Historical and Museum Commission.
- Walters RS, Auchmoody LR. 1993. Factors Limiting Northern Red Oak Reproduction in Pennsylvania. In: Gillespie AR, Parker GR, Pope PE, Rink G. 9th Central Hardwood Forest Conference, General Technical Report NC-161Purdue University, West Lafayette, IN. USDA North Central Forest Experiment Station.
- Ward JS, Montgomery ME, Cheah CASJ, Onken BP, Cowles RS. 2004. Eastern Hemlock Forest: Guidelines to Minimize the Impacts of Hemlock Woolly Adelgid. NA-TP-03-04. Morgantown, WV: USDA Forest Service, Northeastern Area State & Private Forestry.
- Waring KM, O'Hara KL. 2005. Silvicultural strategies in forest ecosystems affected by introduced pests. *Forest Ecology and Management* 209:27-41.
- Warren BH. 1890. Birds of Pennsylvania. Harrisburg, PA.
- Warren County Planning and Zoning Commission . 2005. Warren County Comprehensive Plan Update, August 2005.
- Water Erosion Prediction Project (WEPP). Version 2000.05.24. West Lafayette, Indiana, USA: Agricultural Research Service, National Soil Erosion Research Laboratory.
- Weakland CA, P.B. Wood. 2005. Cerulean Warbler (*Dendroica cerulean*) microhabitat and landscape-level habitat characteristics in southern West Virginia. *The Auk*. 122(2):497-508. Quoted In: P.B. Hamel and K.V. Rosenberg. 2006. Developing management guidelines for cerulean warbler breeding habitat. Proceedings of the 15th Central Hardwoods Forest Conference. Knoxville, TN. in press.

- Weaver WE, D. K. Hagans, J. H. Popenoe. 1995. Magnitude and causes of gully erosion in the lower Redwood Creek basin, northwestern California. In: Nolan, K. M., H. M. Kelsey, and D. C. Marron (eds.). Geomorphic processes and aquatic habitat in the Redwood Creek basin, northwestern California. U.S. Geological Survey Professional Paper 1454. Washington DC: U.S. Government Printing Office.
- Webb WL, D. F. Behrend, B. Saisorn. 1977. Effect of Logging on Songbird Populations in a Northern Hardwood Forest. Wildlife Monographs. No. 55.
- Weigel DR, G. R. Parker. 1995. Tree Regeneration Following Group Selection Harvesting in Southern Indiana. Tenth Central Hardwood Forest Conference.
- Weigel DR. 1994. The Regeneration of Group Selection Openings in Southern Indiana, Technical Brief TB-NC-3. USDA Forest Service, North Central Forest Experiment Station.
- Welsch DJ, D. L. Smart, J. N. Boyer, P. Minken, H. C. Smith, T. L. McCandless. 1995. Forested Wetlands: Functions, Benefits, and the use of Best Management Practices; NA-PR-01-95. Radnor, Pennsylvania, USA: USDA Forest Service, Northern Area State and Private Forestry.
- Wemple BC, J. A. Jones, G. E. Grant. 1996. Channel network extension by logging roads in two basins, western Cascades, Oregon. Water Resources Bulletin 32(6):1195-207.
- Wendell GW, Della-Bianca L, Russell J., and KF Lancaster. 1983. Eastern White Pine Including Eastern Hemlock. pp. 131-134. In: Burns, R.M. 1983. Silvicultural Systems for the Major Forest Types of the United States; Agriculture Handbook No. 445. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Werner SM, Raffa KF. 2000. Effects of forest management practices on the diversity of ground-occurring beetles in mixed northern hardwood forests of the Great Lakes Region. Forest Ecology and Management (139):135-55.
- Western Pennsylvania Conservancy. 1989. Allegheny National Forest Wetland Rare plant survey. Pittsburgh, Pennsylvania, USA : Western Pennsylvania Conservancy.
- Western Pennsylvania Conservancy. 2001. Survey Strategy for Small Whorled-Pogonia (*Isotria medeoloides*) in the Allegheny National Forest. Pittsburgh, PA.
- Wharton EH, R.H. Widman. 2001. The Northeast Region. In United States Timber Industry - An Assessment of Timber Product Output and Use, 1996. Edited by Tony G. Johnson. Ashville, NC: USDA Forest Service. Southern Research Station.
- White DH, B.R. Chapman, J.H. Brunjes IV, R.V. Raftovich Jr., J.T. Seginak. 1999. Abundance and Reproduction of Songbirds in Burned and Unburned Pine Forests of the Georgia Piedmont. Quoted In: USDA-FS 2000. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions, Proceedings of a Special Workshop. Nashville TN. General Technical report NE-288.
- Whitney G. 1984. Fifty years of change in the arboreal vegetation of Heart's Content, an old-growth hemlock-white pine-northern hardwood stand. Ecology (65):403-8.
- Whitney GG. 1994. From coastal wilderness to fruited plain; a history of environmental change in temperate North America, 1500-present. Cambridge, U.K.: Cambridge University Press.
- Wilderness Act. 1964. P.L. 88-577, 1964. RR6 p129.
- Wildlife Society. 2004. Special Coverage: Forest Herbicides and Biodiversity. Wildlife Society Bulletin 32(4):1016-77.
- Williams CE. 1994. Inventory of special concern plants and unique natural communities: Clarion River and Mill Creek corridors, northwestern Pennsylvania. Clarion, Pennsylvania, USA: Clarion University.
- Williams CE. 1996. Variation in Herbaceous Layer Species Richness, Biomass and Cover in Allegheny Plateau Riparian Forests. Report No. 96-1. Clarion, Pennsylvania, USA: Program in Applied Ecology, Clarion University.
- Williams CE, G. E. Baumer, W. J. Moriarity. 2005. Ecological Landtype Mapping Unit Legend for the Allegheny National Forest. April 6, 2005. Warren, PA: Allegheny National Forest.

- Williams CE, William J. Moriarity. 1999. Composition and Structure of Hemlock-Dominated Riparian Forests of the Northern Allegheny Plateau: A Baseline Assessment. Proceedings: Symposium on Sustainable Management of Hemlock Ecosystems in Eastern North America. GTR-NE-267.
- Williams W. 2004. When blade meets bat. Scientific American.
- Witmer GW, D.S. deCalesta. 1992. The need and difficulty of bringing the Pennsylvania deer herd under control. Proc. East. Wildl. Damage Control Conf. (5):130-7.
- Woldendorp G, R.J. Keenan, S. Barry, R.D. Spencer. 2004. Analysis of sampling methods for coarse woody debris. Forest Ecology and Management (198):133-48.
- Wood GW. 1981. Prescribed Fire and Wildlife in Southern Forests. Quoted In: USDA FS 2000. The Role of Fire in Nongame Wildlife Management and Community Restoration: Traditional Uses and New Directions, Proceedings of a Special Workshop. Nashville, TN. General Technical Report NE-288.
- Wood GW, S.K. Cox, S.E. Perry. 2000. A collaborative adaptive management plan for Clemson University Experimental Forest Trail System. Clemson, South Carolina, USA: Clemson University, School of Natural Resources.
- Wood PB, J.P. Duguay, J.V. Nichols. 2005. Cerulean Warbler use of regenerated clearcut and two-age harvests. Wildlife Society Bulletin. 33:851-858. Quoted In: P.B. Hamel. 2006. Adaptive Forest Management for Cerulean Warbler. Proceedings of Society of American Foresters National Convention. in press.
- Woodrey MS. 1986. In Brauning, D.W. 1992. Atlas of Breeding Birds in Pennsylvania. Pittsburgh, Pennsylvania, USA: University of Pittsburgh Press.
- Wunz GA. 1987. Wildlife Habitat Management in Overbrowsed Forests. In: Proceedings of Deer, Forestry, and Agriculture: Interactions and Strategies for Management. Warren, PA.
- Wykoff, William R. 1986. Supplement to The User's Guide for The Stand Prognosis Model-version 5.0 General Technical Report INT-208. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1986. 36 pp.
- Yedlowski JL, J.M. Adovasio, M.R. Buyce, A.G. Quinn. 1998. Habitations or Way Stations? Rockshelter utilization in the Minister Creek drainage, Allegheny National Forest, Pennsylvania. Seattle, Washington.
- Zaczek JJ, Joseph Harding, James Welfey. 1997. Impact of Soil Scarification on the Composition of Regeneration and Species Diversity in an Oak Shelterwood. In: Proceedings, 11th Central hardwood Forest Conference. Columbia, Missouri. March 23-26, 1997. General Technical Report NC-188. U.S. Department of Agriculture, Forest Service, North Central Forest Experimental Station.
- Zaremba RE, et al. 2002. High Allegheny Plateau (HAL) Ecoregional Plan. Final Draft Report. Boston, MA: Eastern Conservation Science, The Nature Conservancy.
- Zimmerman GL. 1984. Analysis of arboreal vegetation and a test of species alternation between hemlock and beech at the Tionesta Research Natural Area in northwestern Pennsylvania. PhD Dissertation. New Brunswick, NJ: Rutgers University.
- Zinn HC, Voorhees SS, Shen SX. 2006. Social Assessment for the Allegheny National Forest. University Park, PA: Pennsylvania State University, Department of Recreation, Park and Tourism Management. Unpublished.
- Zinn HC, Wang GA, Tung YF, Kerstetter DL, Graefe AR. 2003. Stakeholder characteristics, forest value orientations and management preferences for the Allegheny National Forest: Report on a 2002 Survey. University Park, PA: Pennsylvania State University, Recreation and Park Management Program.
- Zinn HC, Yi-Fan Tung, Grace Wang. 2002. Stakeholders' Forest Value Orientations and Management Preferences for the Allegheny National Forest. The Pennsylvania State University Recreation and Park Management Program and Western Washington University.

Chapter 8

Index



Photo courtesy of R Hokans, US Forest Service

8 INDEX

3

303(d) list, 3-28, 3-50, 3-51

A

Accessibility, 3-294, 3-301, 3-383

Age class, 1-1, 1-6, 1-8, 1-9, 2-33, 2-36, 2-39, **2-50**, 2-54, 3-39, 3-44, 3-77, 3-84, 3-88, 3-89, 3-90, 3-93, 3-105, 3-106, 3-108, 3-109, 3-112, 3-113, 3-114, 3-117, 3-118, 3-126, 3-127, 3-131, 3-135, 3-136, 3-137, 3-138, 3-139, 3-141, 3-142, 3-144, 3-147, 3-149, 3-150, 3-157, 3-159, 3-170, 3-182, 3-183, 3-184, 3-196, 3-220, 3-362, 3-372, 3-378, 3-389

air quality, 6-23

Air quality, 2-16, 3-52, 3-53, 3-54, 3-55, 3-56, 3-57, 3-58, 3-59, 3-63, 4-2, 4-3

Carbon monoxide, 3-55, 3-58, 3-61

NAAQS standards, 3-53, 3-54, 3-55, 3-57, 3-59, 3-63

Nitrogen oxide, 3-53, 3-54, 3-57, 3-58

Ozone, 2-16, 2-23, 3-54, 3-57, 3-59, 3-100, 3-182

Particulate matter, 3-53, 3-54, 3-57, 3-58, 3-59, 3-279

Sulfur dioxide, 3-27, 3-52, 3-53, 3-54, 3-57, 3-58

All terrain vehicles, 1-17, 1-18, 1-19, 2-5, 2-7, 2-9, 2-11, 2-13, 2-17, 2-24, 2-27, 2-28, 2-29, 2-35, 2-36, 2-38, 2-41, 2-46, **2-48**, 2-52, 2-58, 3-10, 3-13, 3-14, 3-19, 3-21, 3-37, 3-38, 3-50, 3-51, 3-57, 3-61, 3-62, 3-65, 3-224, 3-225, 3-227, 3-243, 3-246, 3-247, 3-249, 3-251, 3-264, 3-266, 3-267, 3-277, 3-303, 3-304, 3-305, 3-306, 3-308, 3-311, 3-313, 3-320, 3-321, 3-322, 3-325, 3-337, 3-356, 3-357, 3-358, 3-364, 3-365, 3-372, 3-373, 3-377, 3-379, 3-431, 3-432, 3-433, 3-440

Allegheny State Park, 3-1, 3-182, 3-198, 3-200, 3-270, 3-307, 3-422

Allegheny Front, 1-20, 2-13, 2-19, 2-27, 2-28, 2-33, 3-22, 3-23, 3-25, 3-44, 3-50, 3-194, 3-225, 3-226, 3-228, 3-252, 3-330, 3-331, 3-336, 3-337, 3-338, 3-340, 3-341, 3-343, 3-344, 3-353, 3-355, 3-356, 3-359

Allegheny hardwood, 1-7, 1-8, 1-9, 1-11, 2-6, 2-7, 2-8, 2-10, 2-16, 2-23, 2-55, 3-84, 3-86, 3-87, 3-90, 3-102, 3-117, 3-118, 3-123, 3-132, 3-133, 3-135, 3-138, 3-141, 3-148, 3-149, 3-152, 3-155, 3-159, 3-160, 3-164, 3-165, 3-169, 3-182, 3-183, 3-216, 3-227, 3-363, 3-369, 3-395

Allegheny Reservoir, 1-17, 2-5, 2-8, 2-9, 2-11, 2-13, 2-31, 2-37, 3-4, 3-6, 3-21, 3-26, 3-28, 3-180, 3-183, 3-191, 3-205, 3-209, 3-210, 3-223, 3-258, 3-264, 3-279, 3-283, 3-301, 3-303, 3-312, 3-334, 3-340, 3-345, 3-353, 3-355, 3-356, 3-357, 3-448

Allegheny River, 2-3, 2-9, 2-11, 2-13, 2-18, 3-2, 3-4, 3-22, 3-23, 3-28, 3-30, 3-80, 3-130, 3-165, 3-180, 3-181, 3-190, 3-200, 3-209, 3-210, 3-211, 3-224, 3-252, 3-258, 3-259, 3-261, 3-264, 3-265, 3-279, 3-282, 3-283, 3-284, 3-285, 3-286, 3-289,

3-316, 3-344, 3-346, 3-350, 3-353, 3-362, 3-378, 3-399, 3-420, 3-422

Allegheny Snowmobile Loop, 3-303, 3-306, 3-307, 3-334

Allowable sale quantity, 1-1, 1-5, 1-6, 1-12, 1-13, 1-21, 2-4, 2-18, 2-25, 2-30, 2-32, 2-56, 3-155, 3-385, 3-389, 3-390, 3-393, 3-394, 3-395, 3-396, 3-413

Analysis of Timber Harvest Program Capability Report, 1-1, 1-13, 2-56, 3-155, 3-390

Aquatic invertebrates, 2-15, 2-22, 2-25, 3-181, 3-184, 3-203, 3-204, 3-223, 3-224, 3-246, 3-247, 3-275, 3-276, 3-284

Asian longhorned beetle, 3-104

ASQ, 1, 6-2, 6-24, 6-26

Atmospheric deposition, 1-11, 1-21, 2-16, 2-23, 3-8, 3-9, 3-10, 3-19, 3-27, 3-28, 3-49, 3-51, 3-53, 3-54, 3-58, 3-83, 3-88, 3-101, 3-102, 3-123, 3-126, 3-131, 3-162, 3-174, 3-175, 3-183, 3-213, 3-265, 3-268, 3-273, 3-277, 3-279, 3-420

ATV, 1, 6-2

B

Bald eagle, 1-14, 2-16, 2-24, 2-42, 3-180, 3-185, 3-206, 3-209, 3-210, 3-258, 3-288, 3-289, 3-306

Bear Creek, 2-18, 2-20, 3-348, 3-349

Beech bark disease, 1-11, 2-55, 3-82, 3-87, 3-91, 3-93, 3-94, 3-97, 3-98, 3-99, 3-101, 3-103, 3-109, 3-116, 3-120, 3-121, 3-127, 3-128, 3-129, 3-131, 3-132, 3-135, 3-142, 3-143, 3-148, 3-150, 3-152, 3-162, 3-164, 3-174, 3-176, 3-179, 3-183, 3-246, 3-262, 3-263, 3-275, 3-279, 3-322, 3-352, 3-379, 3-389

Best management practices, 3-20, 3-32, 3-33, 3-36, 3-43, 3-48, 3-50, 3-51, 3-263, 3-275, 3-288

Best Management Practices, 1

Bicycle, 2-5, 2-25, 3-14, 3-15, 3-308, 3-313, 3-358

Bluejay/Duhring, 3-250, 3-251, 3-305, 3-320, 3-321, 3-325, 3-326

BMPs, 6-3

Browse, 1-11, 1-14, 3-26, 3-78, 3-87, 3-91, 3-92, 3-93, 3-95, 3-106, 3-111, 3-117, 3-119, 3-121, 3-123, 3-127, 3-129, 3-138, 3-139, 3-142, 3-143, 3-145, 3-146, 3-147, 3-150, 3-152, 3-154, 3-156, 3-158, 3-165, 3-167, 3-169, 3-172, 3-173, 3-204, 3-214, 3-218, 3-341

Buzzard Swamp Wildlife Management Area, 2-41, 2-46, 2-55, 3-106, 3-126, 3-191, 3-209, 3-248, 3-308, 3-315, 3-324, 3-376, 3-395

C

campground, 6-6

Campground, 1-17, 2-25, 2-29, 2-41, 2-42, 2-53, 3-29, 3-295, 3-297, 3-300, 3-301, 3-302, 3-307, 3-308, 3-323, 3-328, 3-332,

- 3-334, 3-340, 3-341, 3-346, 3-350, 3-353, 3-355, 3-356, 3-357, 3-358, 3-361, 3-377, 3-382
- campgrounds, 3-302, 6-6
- Carbon monoxide, 3-55, 3-58, 3-61
- Cerulean warbler, 2-16, 2-22, 2-24, 2-25, 3-184, 3-187, 3-188, 3-195, 3-198, 3-199, 3-200, 3-201, 3-206, 3-208, 3-213, 3-233, 3-234, 3-235, 3-236, 3-237, 3-238, 3-239, 3-260, 3-270, 3-271, 3-272
- Chapman, 3-80, 3-250, 3-305, 3-307, 3-320, 3-321, 3-448
- Cherry scallop shell moth, 3-93, 3-102, 3-174, 3-341
- Chestnut blight, 3-82, 3-97, 3-100
- Chestnut Ridge, 1-20, 2-11, 2-13, 2-19, 2-27, 2-28, 3-194, 3-225, 3-227, 3-229, 3-266, 3-300, 3-321, 3-322, 3-328, 3-331, 3-334, 3-336, 3-337, 3-342, 3-343, 3-344
- Civil rights, 3-433, 3-435
- Clarion Creek, 3-348, 3-349
- Clarion River, 1-3, 1-17, 1-20, 2-6, 2-9, 2-11, 2-13, 2-18, 2-19, 2-25, 2-27, 2-28, 3-23, 3-25, 3-27, 3-28, 3-44, 3-85, 3-130, 3-183, 3-190, 3-194, 3-209, 3-228, 3-284, 3-288, 3-303, 3-317, 3-318, 3-319, 3-330, 3-338, 3-344, 3-345, 3-346, 3-347, 3-348, 3-349, 3-350, 3-351, 3-352, 3-422
- Clean Air Act, 3-52, 3-62
- Coal, 3-3, 3-5, 3-7, 3-52, 3-53, 3-54, 3-57, 3-63, 3-75, 3-208, 3-437
- Congressionally designated areas, 1-2, 1-5, 1-12, 1-17, 1-18, 1-20, 2-3, 2-6, 2-8, 2-9, 2-11, 2-12, 2-13, 2-14, 2-18, 2-20, 2-25, 2-27, 2-28, 2-36, 2-37, 2-41, 2-42, 2-44, 2-46, 3-4, 3-126, 3-130, 3-152, 3-192, 3-211, 3-225, 3-252, 3-299, 3-307, 3-308, 3-315, 3-316, 3-317, 3-323, 3-324, 3-329, 3-331, 3-332, 3-333, 3-337, 3-338, 3-340, 3-341, 3-344, 3-345, 3-348, 3-349, 3-350, 3-352, 3-353, 3-354, 3-355, 3-356, 3-357, 3-358, 3-359, 3-363, 3-364, 3-368, 3-374, 3-377, 3-392, 3-395, 3-422, 3-448, 4-8
- Allegheny Islands Wilderness, 2-5, 3-4, 3-330, 3-331, 3-332, 3-333, 3-335, 3-340, 3-346, 3-353, 3-354, 3-364, 3-368
- Hearts Content, 1-20, 2-5, 2-6, 2-11, 2-13, 2-27, 2-28, 2-43, 2-54, 3-4, 3-91, 3-186, 3-212, 3-302, 3-307, 3-308, 3-317, 3-318, 3-319, 3-323, 3-330, 3-332, 3-338, 3-354, 3-361, 3-364, 3-365, 3-366, 3-368, 3-379
- Hickory Creek Wilderness, 2-5, 2-11, 2-13, 2-19, 2-27, 2-28, 3-4, 3-27, 3-181, 3-182, 3-192, 3-194, 3-226, 3-228, 3-266, 3-267, 3-299, 3-300, 3-307, 3-308, 3-330, 3-331, 3-332, 3-335, 3-340, 3-353, 3-354, 3-361, 3-364, 3-368
- National Recreation Area, 1-2, 1-5, 1-18, 1-20, 2-3, 2-6, 2-9, 2-11, 2-13, 2-14, 2-20, 2-27, 2-28, 2-36, 2-37, 2-41, 2-42, 2-46, 3-4, 3-126, 3-130, 3-152, 3-192, 3-225, 3-252, 3-299, 3-307, 3-308, 3-315, 3-323, 3-324, 3-329, 3-331, 3-337, 3-340, 3-341, 3-352, 3-353, 3-354, 3-355, 3-356, 3-357, 3-358, 3-359, 3-363, 3-364, 3-368, 3-392, 3-448, 4-8
- Wild and Scenic Rivers, 1-5, 1-17, 1-20, 2-8, 2-9, 2-18, 2-25, 2-44, 3-329, 3-344, 3-345, 3-346, 3-348, 3-349, 3-350, 3-352, 3-354, 4-8
- Wilderness study areas, 1-20, 2-3, 2-9, 2-11, 2-13, 2-19, 2-27, 2-28, 2-33, 3-22, 3-23, 3-25, 3-44, 3-50, 3-194, 3-225, 3-226, 3-227, 3-228, 3-229, 3-252, 3-266, 3-299, 3-300, 3-303, 3-318, 3-319, 3-321, 3-322, 3-328, 3-330, 3-331, 3-334, 3-335, 3-336, 3-337, 3-338, 3-340, 3-341, 3-342, 3-343, 3-344, 3-353, 3-355, 3-356, 3-359
- Conifer forest type, 1-7, 2-6, 2-8, 2-10, 2-12, 2-38, 3-33, 3-39, 3-85, 3-89, 3-90, 3-98, 3-113, 3-124, 3-133, 3-134, 3-140, 3-141, 3-142, 3-144, 3-175, 3-182, 3-183, 3-184, 3-188, 3-195, 3-196, 3-197, 3-202, 3-213, 3-221, 3-248, 3-260, 3-262, 3-268, 3-281, 3-282, 3-342, 3-361, 3-386
- Connectivity, 1-2, 1-13, 1-16, 2-21, 2-34, 3-36, 3-39, 3-105, 3-138, 3-140, 3-191, 3-192, 3-213, 3-228, 3-229, 3-241, 3-255, 3-260, 3-266, 3-267, 3-272, 3-274, 3-432
- Cook Forest, 3-1, 3-171, 3-347, 3-367, 3-422
- Core areas, 1-16, 2-8, 2-9, 2-11, 2-13, 2-39, 2-44, 3-140, 3-182, 3-191, 3-192, 3-193, 3-213, 3-228, 3-229, 3-230, 3-241, 3-266, 3-267, 3-274, 3-299, 3-422, 3-423, 3-424, 3-425, 3-426, 3-427, 4-1

D

- Deer herbivory, 1-9, 2-34, 3-78, 3-82, 3-87, 3-88, 3-92, 3-93, 3-94, 3-95, 3-106, 3-108, 3-110, 3-111, 3-112, 3-114, 3-116, 3-119, 3-121, 3-123, 3-124, 3-127, 3-129, 3-138, 3-139, 3-141, 3-143, 3-145, 3-146, 3-150, 3-154, 3-156, 3-158, 3-162, 3-164, 3-166, 3-167, 3-169, 3-172, 3-173, 3-175, 3-184, 3-245, 3-278, 3-378
- Deer Management Assistance Program, 1-15, 2-5, 3-95, 3-156
- Defoliation, 2-5, 2-43, 3-78, 3-80, 3-95, 3-96, 3-97, 3-100, 3-101, 3-102, 3-103, 3-109, 3-126, 3-131, 3-145, 3-174, 3-203, 3-263, 3-268, 3-273, 3-277, 3-342
- design speed, 6-25
- developed recreation, 6-7, 6-11
- Developed recreation, 1-17, 1-18, 2-8, 2-9, 2-11, 2-13, 2-20, 2-36, 2-41, 2-45, 3-31, 3-104, 3-183, 3-296, 3-300, 3-301, 3-312, 3-313, 3-316, 3-326, 3-327, 3-328, 3-334, 3-350, 3-355, 3-446
- Dispersed recreation, 1-2, 1-17, 1-18, 1-21, 2-9, 2-20, 2-39, 2-40, 2-41, 2-43, 3-31, 3-66, 3-130, 3-296, 3-303, 3-311, 3-312, 3-326, 3-328, 3-346, 3-347, 3-364, 3-369, 3-371, 3-382, 3-383, 3-441
- disturbance, 6-5, 6-8, 6-20, 6-21
- Disturbance, 1-8, 1-9, 1-16, 1-18, 1-21, 2-9, 2-11, 2-13, 2-16, 2-19, 2-25, 2-33, 2-34, 2-39, 2-51, 2-59, 3-2, 3-8, 3-9, 3-10, 3-11, 3-15, 3-31, 3-32, 3-37, 3-38, 3-39, 3-41, 3-42, 3-75, 3-78, 3-79, 3-80, 3-81, 3-83, 3-87, 3-89, 3-90, 3-91, 3-93, 3-95, 3-108, 3-114, 3-127, 3-128, 3-130, 3-131, 3-132, 3-133, 3-138, 3-141, 3-143, 3-144, 3-145, 3-149, 3-150, 3-152, 3-162, 3-163, 3-166, 3-170, 3-180, 3-181, 3-182, 3-183, 3-184, 3-191, 3-193, 3-194, 3-195, 3-197, 3-199, 3-203, 3-204, 3-205, 3-209, 3-214, 3-215, 3-221, 3-226, 3-227, 3-231, 3-232, 3-234,

3-241, 3-243, 3-244, 3-245, 3-247, 3-249, 3-258, 3-266, 3-267, 3-268, 3-270, 3-272, 3-273, 3-282, 3-291, 3-292, 3-293, 3-295, 3-314, 3-319, 3-325, 3-328, 3-343, 3-344, 3-353, 3-358, 3-361, 3-366, 3-368, 3-372, 3-373, 3-374, 3-377, 3-378, 3-381, 3-382, 3-396, 3-399, 3-437, 3-444

Climate change, 3-83

Defoliation, 2-5, 2-43, 3-78, 3-80, 3-95, 3-96, 3-97, 3-100, 3-101, 3-102, 3-103, 3-109, 3-126, 3-131, 3-145, 3-174, 3-203, 3-263, 3-268, 3-273, 3-277, 3-342

Disease, 1-1, 1-7, 1-8, 1-11, 2-5, 2-23, 2-33, 2-43, 2-55, 3-11, 3-31, 3-39, 3-41, 3-78, 3-80, 3-82, 3-90, 3-91, 3-93, 3-96, 3-97, 3-98, 3-100, 3-101, 3-102, 3-103, 3-104, 3-110, 3-111, 3-120, 3-126, 3-128, 3-132, 3-136, 3-141, 3-143, 3-145, 3-147, 3-148, 3-152, 3-164, 3-174, 3-181, 3-183, 3-268, 3-271, 3-273, 3-277, 3-286, 3-317, 3-328, 3-361, 3-364, 3-367, 3-369, 3-370, 3-378, 3-396

Drought, Drought, 3-78, 3-96, 3-100, 3-101, 3-102, 3-104, 3-126, 3-130, 3-174, 3-181, 3-268, 3-273, 3-277

Fire, 1-8, 1-9, 1-18, 2-53, 3-13, 3-14, 3-41, 3-57, 3-58, 3-59, 3-60, 3-75, 3-78, 3-80, 3-90, 3-96, 3-125, 3-130, 3-155, 3-165, 3-166, 3-181, 3-217, 3-218, 3-234, 3-242, 3-295, 3-312, 3-333, 3-382, 3-396, 3-420, 4-1, 4-7

Historical harvesting, 3-81, 3-184

Ice storms, 3-80, 3-229, 3-317, 3-351

White-tailed deer, 1-11, 1-14, 2-34, 3-26, 3-78, 3-82, 3-87, 3-91, 3-93, 3-95, 3-106, 3-111, 3-114, 3-117, 3-119, 3-121, 3-123, 3-127, 3-129, 3-142, 3-143, 3-145, 3-146, 3-147, 3-150, 3-154, 3-156, 3-158, 3-167, 3-169, 3-172, 3-173, 3-218, 3-341

Wind events, 1-8, 1-9, 3-31, 3-35, 3-39, 3-75, 3-78, 3-79, 3-90, 3-91, 3-129, 3-141, 3-145, 3-181, 3-229, 3-292, 3-317, 3-351, 3-361, 3-366, 3-367, 3-368, 3-373, 3-378, 3-389, 3-390, 3-396

Down woody debris, 2-15, 2-22, 3-11, 3-15, 3-90, 3-273

Drought, 3-93, 3-95, 3-96, 3-100, 3-101, 3-109, 3-174, 3-183, 3-239

Duhring, 3-229, 3-250, 3-251, 3-305, 3-307, 3-308, 3-320, 3-321, 3-325, 3-326

E

Early structural forest, 1-14, 1-15, 2-3, 2-7, 2-8, 2-10, 2-12, 2-13, 2-19, 2-30, 2-32, 2-35, 2-36, 2-38, 2-39, 3-80, 3-109, 3-131, 3-132, 3-135, 3-140, 3-141, 3-142, 3-144, 3-150, 3-152, 3-156, 3-170, 3-182, 3-183, 3-184, 3-186, 3-195, 3-200, 3-202, 3-203, 3-204, 3-213, 3-214, 3-215, 3-219, 3-221, 3-222, 3-230, 3-237, 3-240, 3-241, 3-244, 3-245, 3-246, 3-247, 3-248, 3-251, 3-260, 3-261, 3-262, 3-273, 3-274, 3-278, 3-279, 3-293, 3-420, 3-446

East Branch of Tionesta, 3-348, 3-349

East Hickory, 3-27, 3-181, 3-182, 3-208, 3-317, 3-318, 3-319

economic, 6-5, 6-7, 6-11, 6-12, 6-24

Economic, 1-3, 1-12, 1-20, 1-22, 2-26, 2-29, 2-33, 2-35, 2-36, 3-1, 3-68, 3-111, 3-118, 3-290, 3-359, 3-385, 3-387, 3-398, 3-399, 3-400, 3-401, 3-402, 3-403, 3-404, 3-405, 3-407, 3-408, 3-409, 3-410, 3-411, 3-412, 3-413, 3-414, 3-415, 3-416, 3-417, 3-418, 3-419, 3-420, 3-421, 3-422, 3-424, 3-426, 3-429, 3-433, 3-434, 3-435, 3-440, 3-441, 3-442, 3-443, 3-447, 3-448, 4-1, 4-9

Elm spanworm, 3-80, 3-93, 3-95, 3-96, 3-174, 3-216

Endangered Species Act, 2-16, 3-198, 3-288

Equestrian use, 1-2, 1-17, 1-18, 1-19, 2-5, 2-8, 2-9, 2-11, 2-13, 2-25, 2-36, 2-38, 2-41, 2-46, 2-52, 2-58, 3-10, 3-14, 3-15, 3-17, 3-18, 3-19, 3-21, 3-37, 3-42, 3-47, 3-64, 3-65, 3-213, 3-243, 3-255, 3-274, 3-292, 3-293, 3-295, 3-303, 3-306, 3-307, 3-311, 3-317, 3-319, 3-322, 3-323, 3-324, 3-325, 3-326, 3-334, 3-356, 3-357, 3-373, 3-377, 3-398, 3-432

Erosion, 1-18, 1-19, 1-21, 2-23, 2-26, 3-3, 3-8, 3-9, 3-10, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-20, 3-21, 3-32, 3-36, 3-37, 3-41, 3-49, 3-50, 3-68, 3-72, 3-182, 3-288, 3-303, 3-358, 3-377, 3-378, 3-382, 3-444

Even-aged management, 1-9, 1-10, 2-6, 2-8, 2-10, 2-12, 2-30, 2-32, 2-39, 2-49, 2-57, 3-11, 3-12, 3-15, 3-16, 3-17, 3-21, 3-87, 3-109, 3-112, 3-116, 3-117, 3-131, 3-132, 3-133, 3-135, 3-136, 3-139, 3-141, 3-145, 3-151, 3-152, 3-155, 3-159, 3-165, 3-172, 3-176, 3-221, 3-375

F

Fall cankerworm, 3-93, 3-174

Fencing, 1-9, 1-15, 2-47, 2-51, 3-14, 3-48, 3-86, 3-87, 3-88, 3-106, 3-108, 3-117, 3-120, 3-121, 3-123, 3-124, 3-143, 3-145, 3-146, 3-147, 3-154, 3-156, 3-158, 3-168, 3-169, 3-172, 3-173, 3-217, 3-218, 3-261, 3-262, 3-295, 3-341, 3-342, 3-375, 3-397, 3-418

fertilization, 6-22

Fertilization, 1-9, 2-47, 2-51, 3-12, 3-15, 3-16, 3-35, 3-106, 3-123, 3-156, 3-158, 3-295

Forest health, 1-1, 1-6, 1-8, 1-9, 1-10, 1-11, 1-12, 2-4, 2-5, 2-19, 2-32, 2-33, 2-34, 2-49, 2-55, 3-30, 3-39, 3-41, 3-51, 3-77, 3-78, 3-82, 3-87, 3-92, 3-93, 3-94, 3-100, 3-103, 3-107, 3-109, 3-110, 3-115, 3-116, 3-119, 3-126, 3-128, 3-130, 3-131, 3-132, 3-133, 3-137, 3-138, 3-139, 3-144, 3-147, 3-148, 3-150, 3-154, 3-162, 3-166, 3-174, 3-175, 3-183, 3-229, 3-239, 3-268, 3-271, 3-290, 3-317, 3-351, 3-357, 3-378, 3-383, 3-393, 3-396, 3-432, 3-433, 3-437

Asian longhorned beetle, 3-104

Beech bark disease, 1-11, 2-55, 3-82, 3-87, 3-91, 3-93, 3-94, 3-97, 3-98, 3-101, 3-103, 3-109, 3-116, 3-120, 3-121, 3-127, 3-128, 3-129, 3-131, 3-132, 3-135, 3-142, 3-143, 3-148, 3-150, 3-152, 3-162, 3-164, 3-174, 3-176, 3-179, 3-183, 3-262, 3-275, 3-279, 3-379

Cherry scallop shell moth, 3-93, 3-102, 3-174, 3-341

Chestnut blight, 3-82, 3-97, 3-100

Deer herbivory, 1-9, 2-34, 3-78, 3-82, 3-87, 3-88, 3-92, 3-93, 3-94, 3-95, 3-106, 3-108, 3-110, 3-111, 3-112, 3-114, 3-116, 3-119, 3-121, 3-123, 3-124, 3-127, 3-129, 3-138, 3-139, 3-141, 3-143, 3-145, 3-146, 3-150, 3-154, 3-156, 3-158, 3-162, 3-164, 3-166, 3-167, 3-169, 3-172, 3-173, 3-175, 3-184, 3-245, 3-278, 3-378

Defoliation, 2-5, 2-43, 3-78, 3-80, 3-95, 3-96, 3-97, 3-100, 3-101, 3-102, 3-103, 3-109, 3-126, 3-131, 3-145, 3-174, 3-203, 3-263, 3-268, 3-273, 3-277, 3-342

Elm spanworm, 3-80, 3-93, 3-95, 3-96, 3-174, 3-216

Emerald ash borer, 3-82, 3-103, 3-104, 3-275, 3-276

Fall cankerworm, 3-93, 3-174

Forest health monitoring, 3-87, 3-94, 3-100, 3-103, 3-128, 3-130, 3-166

Forest tent caterpillar, 3-80, 3-93, 3-95, 3-96, 3-174

Gypsy moth, 3-82, 3-93, 3-95, 3-96, 3-97, 3-102, 3-109, 3-174, 3-340, 3-341, 3-342, 3-389

Hemlock woolly adelgid, 1-7, 1-11, 2-55, 3-33, 3-82, 3-91, 3-93, 3-103, 3-104, 3-109, 3-116, 3-135, 3-142, 3-148, 3-164, 3-174, 3-175, 3-188, 3-195, 3-198, 3-212, 3-261, 3-262, 3-263, 3-268, 3-273, 3-275, 3-276, 3-279, 3-281, 3-282, 3-379

Insects and disease, Disturbance

- Insects and disease, 1-1, 1-8, 1-13, 2-5, 3-11, 3-78, 3-80, 3-82, 3-93, 3-95, 3-96, 3-98, 3-103, 3-109, 3-110, 3-111, 3-126, 3-141, 3-147, 3-148, 3-152, 3-174, 3-181, 3-183, 3-203, 3-204, 3-221, 3-239, 3-246, 3-268, 3-273, 3-276, 3-277, 3-283, 3-328, 3-361, 3-367, 3-369, 3-370, 3-378, 3-393, 3-396

Interfering plants, 1-9, 1-11, 2-7, 2-8, 2-10, 2-12, 3-26, 3-30, 3-45, 3-78, 3-82, 3-88, 3-92, 3-93, 3-94, 3-111, 3-114, 3-119, 3-122, 3-123, 3-127, 3-129, 3-139, 3-143, 3-145, 3-146, 3-150, 3-157, 3-173, 3-189, 3-208, 3-210, 3-211, 3-214, 3-225, 3-265, 3-375, 3-378

Ozone injury, 2-23, 3-54, 3-100

Pear thrips, 3-82, 3-93, 3-96, 3-97, 3-174

Soil nutrient limitations, 1-11, 3-93

Sudden oak death, 3-82, 3-103, 3-105

Sugar maple decline, 2-55, 3-101, 3-102, 3-109, 3-174, 3-363

Tree mortality, 1-11, 3-92, 3-94, 3-95, 3-102, 3-110, 3-111, 3-145, 3-146, 3-148, 3-171, 3-173, 3-277, 3-389, 3-394

Windstorms, 3-78, 3-93, 3-126, 3-174, 3-183, 3-268, 3-273, 3-277

Forest health monitoring, 3-87, 3-94, 3-100, 3-103, 3-128, 3-130, 3-166

Forest products, 1-6, 1-7, 1-11, 1-12, 1-13, 2-56, 3-77, 3-81, 3-110, 3-150, 3-152, 3-167, 3-173, 3-179, 3-303, 3-314, 3-380, 3-382, 3-385, 3-393, 3-398, 3-418, 3-421, 3-431, 3-447, 4-3

Forest tent caterpillar, 3-80, 3-93, 3-95, 3-96, 3-174

G

Game species, 1-13, 1-15, 2-7, 2-15, 2-39, 2-40, 3-26, 3-82, 3-180, 3-184, 3-188, 3-194, 3-195, 3-204, 3-205, 3-212, 3-217, 3-221, 3-228, 3-230, 3-246, 3-247, 3-248, 3-249, 3-250, 3-251, 3-260, 3-262, 3-279, 3-432

Grunderville, 3-250, 3-320, 3-321

Gypsy moth, 3-82, 3-93, 3-95, 3-96, 3-97, 3-102, 3-109, 3-174, 3-340, 3-341, 3-342, 3-389

H

Habitat composition, 3-184, 3-188, 3-212, 3-213, 3-221, 3-225, 3-260, 3-262, 3-279

Habitat patterns, 1-13, 3-184, 3-191, 3-212, 3-213, 3-226, 3-260, 3-265

Habitat structure, 2-48, 2-52, 3-213, 3-260

Hearts Content, 1-20, 2-5, 2-6, 2-11, 2-13, 2-27, 2-28, 2-43, 2-54, 3-4, 3-91, 3-186, 3-212, 3-302, 3-307, 3-308, 3-317, 3-318, 3-319, 3-323, 3-330, 3-332, 3-338, 3-354, 3-361, 3-364, 3-365, 3-366, 3-368, 3-379

herbicide, 6-4, 6-12

Herbicide, 1-1, 1-9, 2-7, 2-8, 2-10, 2-12, 2-17, 2-24, 2-25, 2-26, 2-47, **2-51**, 3-12, 3-33, 3-34, 3-35, 3-36, 3-41, 3-45, 3-46, 3-58, 3-86, 3-88, 3-106, 3-114, 3-118, 3-119, 3-120, 3-121, 3-122, 3-126, 3-143, 3-145, 3-146, 3-147, 3-157, 3-158, 3-168, 3-172, 3-173, 3-212, 3-213, 3-215, 3-216, 3-217, 3-224, 3-225, 3-226, 3-240, 3-244, 3-246, 3-247, 3-259, 3-265, 3-294, 3-295, 3-340, 3-373, 3-375, 3-377, 3-433, 3-434, 3-435, 3-436, 3-437, 3-438, 3-439, 3-441, 3-443, 3-444, 3-445, 4-3, 4-8

Herbicides, 1-9, 2-17, 2-24, **2-51**, 3-14, 3-35, 3-36, 3-41, 3-42, 3-45, 3-58, 3-119, 3-121, 3-122, 3-156, 3-215, 3-216, 3-224, 3-225, 3-226, 3-246, 3-247, 3-258, 3-265, 3-294, 3-383, 3-418, 3-433, 3-435, 3-436, 3-437, 3-438, 3-439, 3-440, 3-441, 3-443, 3-444, 3-446

heritage resources, 6-15

Heritage resources, 1-2, 2-43, 3-45, 3-206, 3-296, 3-345, 3-352, 3-369, 3-380, 3-381, 3-382, 3-383, 3-384, 4-4

Heritage Resources, 6-23

Highland, 3-250, 3-251, 3-305, 3-320, 3-321, 5-2, 5-4

Hiking, 1-17, 1-18, 2-5, 2-18, 2-20, 2-30, 2-41, 2-52, 3-14, 3-15, 3-38, 3-65, 3-297, 3-303, 3-307, 3-308, 3-309, 3-310, 3-313, 3-323, 3-332, 3-333, 3-334, 3-343, 3-346, 3-353, 3-356, 3-357, 3-358, 3-364, 3-365, 3-371, 3-431, 3-445

Historic area, 1-5, 1-17, 1-20, 2-6, 2-10, 2-12, 2-14, 2-20, 2-43, 2-46, 3-302, 3-315, 3-324, 3-346, 3-354, 3-360, 3-362, 3-365, 3-369, 3-383, 3-395

Human health, 1-1, 1-9, 2-7, 2-8, 2-10, 2-12, 2-24, 3-34, 3-36, 3-46, 3-52, 3-54, 3-55, 3-60, 3-122, 3-290, 3-433, 3-435, 3-436, 3-437, 3-441

Hunting, 1-13, 1-15, 1-21, 2-7, 2-39, 2-40, 2-41, 3-73, 3-80, 3-167, 3-180, 3-184, 3-188, 3-195, 3-204, 3-205, 3-212, 3-246, 3-247, 3-248, 3-251, 3-262, 3-279, 3-303, 3-314, 3-319, 3-332, 3-333, 3-343, 3-353, 3-356, 3-357, 3-379, 3-381, 3-413, 3-420, 3-431, 3-432, 3-433

I

Important Bird Areas, 3-182, 3-208

Important Mammal Areas, 3-182

Impoundments, 2-52, 3-26, 3-45, 3-183, 3-189, 3-190, 3-191, 3-205, 3-209, 3-221, 3-223, 3-247, 3-253, 3-256, 3-263, 3-276, 3-277, 3-279, 3-287, 3-345

Indiana bat, 1-14, 2-16, 2-24, 3-209, 3-257, 3-258, 3-288, 6-10

Intensive Use Areas, 1-2, 1-19, 2-3, 2-7, 2-9, 2-11, 2-13, 2-29, 2-38, 2-46, 2-58, 3-17, 3-18, 3-38, 3-42, 3-48, 3-213, 3-224, 3-227, 3-228, 3-229, 3-232, 3-233, 3-243, 3-249, 3-250, 3-251, 3-252, 3-255, 3-266, 3-274, 3-293, 3-295, 3-305, 3-306, 3-318, 3-320, 3-321, 3-322, 3-325, 3-326, 3-337, 3-398

Interfering plants, 1-9, 1-11, 2-7, 2-8, 2-10, 2-12, 3-26, 3-30, 3-45, 3-78, 3-82, 3-87, 3-88, 3-92, 3-93, 3-94, 3-111, 3-114, 3-119, 3-122, 3-123, 3-124, 3-125, 3-127, 3-128, 3-129, 3-139, 3-143, 3-145, 3-146, 3-150, 3-157, 3-169, 3-173, 3-189, 3-208, 3-210, 3-211, 3-214, 3-225, 3-265, 3-362, 3-375, 3-378

K

Kane Experimental Forest, 1-5, 1-17, 1-20, 2-6, 2-10, 2-12, 2-14, 2-43, 2-44, 2-46, 3-11, 3-36, 3-58, 3-62, 3-128, 3-299, 3-314, 3-315, 3-324, 3-360, 3-362, 3-363, 3-364, 3-365, 3-369, 3-370, 3-395

Kinzua Creek, 1-20, 2-18, 3-23, 3-44, 3-189, 3-209, 3-305, 3-345, 3-348, 3-349

L

Lamentation Run, 2-20, 3-299, 3-317, 3-318, 3-319

Late structural forest, 1-8, 1-13, 1-14, 1-15, 1-16, 2-3, 2-7, 2-8, 2-9, 2-10, 2-11, 2-12, 2-13, 2-14, 2-16, 2-21, 2-22, 2-28, 2-39, 2-40, 2-43, 2-44, 2-45, 2-46, 2-54, 2-57, 3-39, 3-41, 3-79, 3-89, 3-90, 3-91, 3-112, 3-114, 3-117, 3-131, 3-132, 3-135, 3-136, 3-137, 3-138, 3-139, 3-140, 3-141, 3-142, 3-143, 3-144, 3-147, 3-152, 3-159, 3-160, 3-171, 3-183, 3-184, 3-185, 3-186, 3-187, 3-191, 3-192, 3-193, 3-195, 3-197, 3-204, 3-212, 3-213, 3-219, 3-220, 3-221, 3-222, 3-227, 3-228, 3-229, 3-230, 3-231, 3-233, 3-238, 3-241, 3-245, 3-248, 3-254, 3-255, 3-256, 3-257, 3-260, 3-261, 3-262, 3-266, 3-273, 3-274, 3-281, 3-287, 3-314, 3-315, 3-324, 3-361, 3-362, 3-364, 3-366, 3-367, 3-368, 3-378, 3-389

Longhouse, 1-20, 2-3, 2-9, 2-11, 2-13, 3-228, 3-250, 3-251, 3-252, 3-303, 3-317, 3-318, 3-319, 3-320, 3-321, 3-322, 3-372, 3-377

M

maintenance level, 6-13

Management indicator species, 1-14, 2-3, 2-15, 2-22, 2-25, 3-184, 3-194, 3-212, 3-213, 3-246, 3-260
 Aquatic invertebrates, 2-15, 2-22, 2-25, 3-181, 3-184, 3-203, 3-204, 3-223, 3-224, 3-246, 3-247, 3-275, 3-276, 3-284
 Cerulean warbler, 2-16, 2-22, 2-24, 2-25, 3-184, 3-187, 3-188, 3-198, 3-199, 3-200, 3-201, 3-208, 3-213, 3-233, 3-234, 3-235, 3-236, 3-237, 3-238, 3-239, 3-270, 3-271, 3-272
 Mourning warbler, 2-3, 2-22, 2-25, 3-184, 3-185, 3-195, 3-202, 3-203, 3-213, 3-244, 3-245, 3-277, 3-278
 Northern goshawk, 2-22, 2-25, 3-194, 3-195, 3-196, 3-206, 3-213, 3-230, 3-260, 3-268, 3-270, 3-281
 Timber rattlesnake, 2-3, 2-25, 3-180, 3-184, 3-201, 3-202, 3-228, 3-230, 3-239, 3-240, 3-241, 3-242, 3-254, 3-255, 3-272, 3-273, 3-274, 3-275, 3-282

Management Indicator Species, 1, 6-14

Marienville ATV Trail, 3-305

Marshburg, 3-250, 3-305, 3-306, 3-320, 3-321

Migratory birds, 3-208, 3-257

Minister Valley, 1-20, 2-3, 2-9, 2-11, 2-13, 2-19, 2-27, 2-28, 3-299, 3-300, 3-303, 3-318, 3-319, 3-328, 3-330, 3-331, 3-334, 3-335, 3-336, 3-337, 3-338, 3-341, 3-342, 3-343, 3-344

Morrison, 2-3, 2-13, 2-19, 2-27, 3-191, 3-192, 3-194, 3-227, 3-228, 3-266, 3-299, 3-302, 3-317, 3-318, 3-319

Mourning warbler, 2-3, 2-22, 2-25, 3-184, 3-185, 3-195, 3-202, 3-203, 3-213, 3-244, 3-245, 3-277, 3-278

N

National Environmental Policy Act, 3-36, 3-71, 4-1, 4-3, 4-7

National Forest Management Act, 1-1, 1-4, 2-19, 3-179, 3-205

National Visitor Use Monitoring, 3-297, 3-310, 3-332, 3-339, 3-419, 3-431

nitrogen, 6-16

Nitrogen, 2-16, 2-23, 3-12, 3-13, 3-15, 3-16, 3-33, 3-36, 3-53, 3-54, 3-57, 3-58, 3-61, 3-98, 3-123, 3-295

Nitrogen oxide, 3-53, 3-54, 3-57, 3-58

NNIS, 1, 6-16

Non-motorized recreation, 1-2, 1-17, 1-18, 1-19, 2-5, 2-7, 2-9, 2-11, 2-13, 2-18, 2-20, 2-30, 2-36, 2-38, 2-40, 2-41, 2-42, 2-48, 2-52, 2-53, 2-58, 3-10, 3-14, 3-15, 3-17, 3-18, 3-37, 3-38, 3-47, 3-64, 3-65, 3-66, 3-67, 3-68, 3-72, 3-243, 3-255, 3-292, 3-295, 3-297, 3-299, 3-300, 3-303, 3-304, 3-307, 3-308, 3-309, 3-310, 3-311, 3-313, 3-316, 3-317, 3-319, 3-322, 3-323, 3-325, 3-326, 3-328, 3-332, 3-333, 3-334, 3-343, 3-346, 3-353, 3-355, 3-356, 3-357, 3-358, 3-359, 3-364, 3-365, 3-371, 3-373, 3-398, 3-431, 3-432, 3-445, 3-446

Non-native invasive species, 1-13, 1-15, 2-47, 2-51, 3-41, 3-82, 3-132, 3-290, 3-291, 3-292, 3-293, 3-294, 3-295, 3-397

North Country National Scenic Trail, 1-20, 2-6, 3-304, 3-307, 3-313, 3-334, 3-342, 3-353, 3-359, 3-361, 3-372
Northeastern bulrush, 1-14, 3-208, 3-209, 3-211, 3-259, 3-289
Northern goshawk, 2-22, 2-25, 3-184, 3-185, 3-187, 3-193, 3-194, 3-195, 3-196, 3-197, 3-206, 3-213, 3-228, 3-229, 3-230, 3-231, 3-232, 3-233, 3-260, 3-268, 3-269, 3-270, 3-281, 3-282, 3-361
northern hardwood, 6-7
Northern hardwood, 1-7, 1-9, 1-11, 2-12, 2-14, 2-15, 2-21, 2-23, 2-43, 2-55, 3-80, 3-84, 3-86, 3-87, 3-90, 3-91, 3-93, 3-96, 3-98, 3-102, 3-118, 3-126, 3-128, 3-129, 3-132, 3-133, 3-135, 3-141, 3-144, 3-148, 3-149, 3-152, 3-155, 3-159, 3-160, 3-164, 3-168, 3-174, 3-181, 3-182, 3-197, 3-202, 3-236, 3-273, 3-363, 3-366, 3-378, 3-394
Northern Research Station, 2-44, 3-240
Northern riffleshell, 1-14, 2-16, 2-24, 3-180, 3-207, 3-209, 3-210, 3-211, 3-258, 3-259, 3-284, 3-289

O

oak, 6-14
Oak, 1-7, 1-9, 1-10, 1-15, 1-16, 2-2, 2-3, 2-6, 2-7, 2-8, 2-10, 2-12, 2-35, 2-36, 2-39, 2-48, **2-51**, 2-54, 2-57, 3-14, 3-80, 3-83, 3-84, 3-85, 3-86, 3-87, 3-89, 3-96, 3-101, 3-102, 3-103, 3-105, 3-115, 3-117, 3-121, 3-122, 3-124, 3-125, 3-126, 3-127, 3-130, 3-131, 3-132, 3-133, 3-134, 3-135, 3-140, 3-141, 3-142, 3-144, 3-151, 3-152, 3-154, 3-155, 3-156, 3-157, 3-159, 3-160, 3-161, 3-165, 3-166, 3-168, 3-169, 3-181, 3-182, 3-183, 3-184, 3-188, 3-195, 3-197, 3-199, 3-200, 3-201, 3-204, 3-210, 3-211, 3-213, 3-217, 3-218, 3-221, 3-222, 3-227, 3-233, 3-234, 3-235, 3-239, 3-247, 3-248, 3-254, 3-256, 3-260, 3-261, 3-262, 3-270, 3-271, 3-279, 3-287, 3-289, 3-295, 3-342, 3-373, 3-385, 3-386, 3-388, 3-390, 3-394, 3-411, 3-420
Oak forest type, 1-15, 2-6, 2-7, 2-8, 2-36, 2-39, 2-57, 3-80, 3-85, 3-96, 3-130, 3-151, 3-159, 3-165, 3-166, 3-181, 3-188, 3-195, 3-200, 3-201, 3-213, 3-221, 3-227, 3-233, 3-248, 3-256, 3-262, 3-279, 3-287, 3-394
OHM, 1
Oil and gas development, 1-4, 1-12, 1-18, 1-21, 1-22, 2-3, 2-4, 2-5, 2-14, 2-17, 2-19, 2-20, 2-25, 2-28, 2-30, 2-31, **2-50**, 2-59, 2-60, 3-4, 3-5, 3-7, 3-20, 3-25, 3-26, 3-27, 3-28, 3-48, 3-49, 3-50, 3-57, 3-62, 3-73, 3-84, 3-108, 3-131, 3-132, 3-134, 3-163, 3-164, 3-167, 3-168, 3-181, 3-183, 3-190, 3-192, 3-193, 3-194, 3-212, 3-219, 3-227, 3-228, 3-230, 3-235, 3-250, 3-252, 3-261, 3-263, 3-264, 3-266, 3-267, 3-268, 3-269, 3-270, 3-271, 3-272, 3-273, 3-275, 3-276, 3-277, 3-278, 3-281, 3-282, 3-283, 3-285, 3-288, 3-289, 3-295, 3-299, 3-300, 3-312, 3-315, 3-326, 3-327, 3-334, 3-341, 3-342, 3-343, 3-347, 3-353, 3-358, 3-359, 3-361, 3-363, 3-365, 3-366, 3-367, 3-368, 3-369, 3-370, 3-372, 3-373, 3-379, 3-392, 3-399, 3-404, 3-409, 3-410, 3-411, 3-418, 3-419, 3-420, 3-421, 3-424, 3-433, 3-437, 3-441, 3-442, 3-443, 4-8

Open riding, 1-19, 2-58, 3-17, 3-18, 3-19, 3-37, 3-47, 3-243, 3-274, 3-293, 3-307, 3-322, 3-323, 3-325, 3-326
Owls Nest, 2-3, 3-250, 3-251, 3-305, 3-320, 3-321
Ozone, 2-16, 2-23, 3-54, 3-57, 3-59, 3-100, 3-182
Ozone injury, 2-23, 3-54, 3-100

P

Particulate matter, 3-53, 3-54, 3-57, 3-58, 3-59, 3-279
Pear thrips, 3-82, 3-93, 3-96, 3-97, 3-174
Pennsylvania Department of Conservation and Natural Resources, 3-48, 3-104, 3-176, 3-296, 3-298, 3-302, 3-306, 3-307, 3-347, 3-348, 3-349, 5-1
Pennsylvania Department of Environmental Protection, 1-22, 3-27, 3-28, 3-43, 3-48, 3-50, 3-204, 3-253, 3-352, 4-6, 5-1
Pennsylvania Fish and Boat Commission, 3-49, 3-189, 3-190, 3-191, 3-252, 3-272, 3-275, 3-347
Pennsylvania Game Commission, 1-15, 2-5, 2-22, 2-41, 3-48, 3-82, 3-127, 3-154, 3-173, 3-176, 3-186, 3-248, 3-261, 3-265, 3-266, 3-274, 3-275, 3-296, 3-298, 3-307, 3-346, 3-433, 3-448, 5-1
Pennsylvania Scenic Rivers, 3-347, 3-349
Pennsylvania Wilds, 3-298, 3-311, 3-400, 3-419, 3-423, 3-424, 3-425, 3-426, 3-427, 3-428, 3-429, 3-430, 3-433, 3-437, 3-442, 3-443
Population trends, 3-308, 3-442
 Age, 3-425
 Education, 3-426
 Ethnicity, 3-426, 3-434
 Gender, 3-426, 3-434
 Marital status, 3-426, 3-434
 Population movement, 3-428
prescribed fire, 6-4, 6-8, 6-9, 6-18, 6-25, 6-27
Prescribed fire, 1-9, 1-11, 1-15, **2-51**, 3-13, 3-14, 3-41, 3-53, 3-57, 3-58, 3-59, 3-60, 3-63, 3-125, 3-132, 3-157, 3-159, 3-212, 3-213, 3-217, 3-218, 3-221, 3-233, 3-242, 3-244, 3-262, 3-274, 3-373, 3-382, 3-418, 3-446, 4-1
Present net value, 3-410
Prohibited riding, 3-322, 3-323
Protected water uses, 3-27
Public involvement, 1-1, 1-3, 1-5, 1-6, 1-7, 1-8, 1-10, 1-13, 1-14, 1-16, 1-17, 1-19, 1-20, 1-21, 1-22, 2-2, 2-3, 2-14, 2-18, 2-21, 2-26, 2-29, 2-39, 2-42, 2-43, 2-44, 2-45, 3-1, 3-20, 3-21, 3-29, 3-31, 3-34, 3-36, 3-48, 3-49, 3-51, 3-64, 3-65, 3-67, 3-68, 3-69, 3-70, 3-73, 3-104, 3-122, 3-152, 3-162, 3-163, 3-166, 3-167, 3-168, 3-170, 3-171, 3-173, 3-174, 3-177, 3-179, 3-181, 3-183, 3-184, 3-196, 3-231, 3-239, 3-242, 3-253, 3-258, 3-261, 3-262, 3-275, 3-296, 3-306, 3-308, 3-311, 3-312, 3-313, 3-314, 3-316, 3-322, 3-330, 3-335, 3-340, 3-344, 3-345, 3-346, 3-348, 3-352, 3-353, 3-354, 3-357, 3-363, 3-365, 3-369, 3-379, 3-380, 3-381, 3-406, 3-407, 3-408, 3-421, 3-

424, 3-429, 3-431, 3-433, 3-436, 3-437, 3-438, 3-440, 3-441, 3-442, 3-447, 3-448, 4-1, 4-6, 4-8, 5-3

Purpose and need, 1-1, 2-1, 2-2, 2-19, 2-21, 2-25, 2-37, 3-110

R

RARE II, 3-330, 3-331, 3-335, 3-338, 3-353, 6-20

Recreation Opportunity Spectrum, 2-40, 2-41, 3-298, 3-299, 3-300, 3-311, 3-312, 3-313, 3-314, 3-315, 3-316, 3-317, 3-328, 3-377, 3-379, 1

Roaded modified, 3-300, 3-313, 3-315, 3-327, 3-379

Roaded natural, 2-38, 2-39, 2-40, 2-41, 2-42, 2-43, 3-299, 3-300, 3-312, 3-314, 3-315, 3-316, 3-317, 3-327, 3-328, 3-379

Rural, 3-312, 3-316, 3-317

Semi-primitive motorized, 3-316, 3-355

Semi-primitive non-motorized, 1-18, 2-41, 2-42, 3-299, 3-312, 3-315, 3-316, 3-317

reforestation, 6-12, 6-15

Reforestation, 1-1, 1-7, 1-9, 1-10, 1-12, 1-16, 2-5, 2-38, 2-40, 2-41, 2-47, **2-51**, **2-52**, 3-26, 3-33, 3-35, 3-40, 3-41, 3-45, 3-87, 3-88, 3-93, 3-105, 3-106, 3-107, 3-108, 3-109, 3-110, 3-111, 3-112, 3-116, 3-119, 3-120, 3-124, 3-126, 3-127, 3-131, 3-133, 3-136, 3-141, 3-145, 3-150, 3-154, 3-155, 3-156, 3-158, 3-162, 3-163, 3-164, 3-169, 3-172, 3-173, 3-178, 3-179, 3-213, 3-224, 3-234, 3-240, 3-245, 3-246, 3-261, 3-262, 3-279, 3-294, 3-295, 3-341, 3-342, 3-394, 3-397, 3-421, 3-433, 3-434, 3-445, 3-446, 4-3

Regional Forester Sensitive Species, 1, 6-22

Regional Forester Sensitive Species List, 2-21, 3-181, 3-206, 3-223, 3-230, 3-252

Remote habitat, 1-16, 1-17, 2-58, 3-184, 3-191, 3-194, 3-213, 3-226, 3-227, 3-228, 3-243, 3-255, 3-260, 3-266, 3-274, 3-275

research, 6-13, 6-16

Research, 1-5, 1-9, 1-17, 1-20, 2-5, 2-6, 2-10, 2-12, 2-14, 2-15, 2-18, 2-19, 2-20, 2-23, 2-25, 2-27, 2-28, 2-43, 2-44, 2-46, 2-54, 3-4, 3-11, 3-20, 3-27, 3-32, 3-34, 3-38, 3-45, 3-58, 3-88, 3-98, 3-101, 3-102, 3-103, 3-112, 3-113, 3-116, 3-119, 3-120, 3-121, 3-123, 3-126, 3-146, 3-149, 3-152, 3-196, 3-198, 3-199, 3-200, 3-212, 3-216, 3-221, 3-226, 3-231, 3-234, 3-236, 3-237, 3-242, 3-314, 3-315, 3-324, 3-333, 3-340, 3-342, 3-355, 3-360, 3-362, 3-363, 3-364, 3-365, 3-366, 3-367, 3-368, 3-369, 3-370, 3-374, 3-384, 3-422, 3-433, 3-435, 3-436, 4-1, 4-3, 4-5, 4-7, 4-8

Research Natural Area, 1-5, 1-17, 1-20, 2-5, 2-6, 2-14, 2-18, 2-19, 2-20, 2-27, 2-28, 2-43, 2-46, 2-54, 3-4, 3-126, 3-212, 3-267, 3-314, 3-315, 3-324, 3-355, 3-360, 3-363, 3-364, 3-365, 3-366, 3-367, 3-368, 3-374, 1

Restricted riding, 3-47, 3-323

Rimrock, 3-319

riparian, 6-20

Riparian areas, 1-2, 1-3, 1-7, 1-15, 1-21, 2-3, 2-4, 2-7, 2-9, 2-11, 2-13, 2-17, 2-21, 2-22, 2-23, 2-24, 2-25, 2-36, 2-47, **2-48**, **2-50**, 3-23, 3-26, 3-29, 3-30, 3-31, 3-32, 3-33, 3-35, 3-37, 3-38, 3-39, 3-40, 3-41, 3-42, 3-43, 3-44, 3-45, 3-47, 3-48, 3-49, 3-50, 3-51, 3-68, 3-70, 3-77, 3-79, 3-85, 3-94, 3-104, 3-110, 3-113, 3-115, 3-117, 3-135, 3-144, 3-147, 3-151, 3-155, 3-156, 3-184, 3-186, 3-188, 3-192, 3-200, 3-205, 3-213, 3-221, 3-223, 3-224, 3-248, 3-254, 3-256, 3-260, 3-270, 3-281, 3-282, 3-285, 3-287, 3-290, 3-291, 3-292, 3-308, 3-314, 3-326, 3-349, 3-351, 3-389, 3-448, 4-4, 4-5

Riparian corridor, 1-2, 1-3, 1-7, 1-15, 1-21, 2-3, 2-4, 2-7, 2-9, 2-11, 2-13, 2-17, 2-21, 2-22, 2-23, 2-24, 2-25, 2-36, 2-47, **2-48**, **2-50**, 3-23, 3-26, 3-29, 3-30, 3-31, 3-32, 3-33, 3-35, 3-37, 3-38, 3-39, 3-40, 3-41, 3-42, 3-43, 3-44, 3-45, 3-47, 3-48, 3-49, 3-50, 3-51, 3-68, 3-70, 3-77, 3-79, 3-85, 3-94, 3-104, 3-110, 3-113, 3-115, 3-117, 3-135, 3-144, 3-147, 3-151, 3-155, 3-156, 3-184, 3-186, 3-188, 3-192, 3-200, 3-205, 3-213, 3-221, 3-223, 3-224, 3-248, 3-254, 3-256, 3-260, 3-270, 3-281, 3-282, 3-285, 3-287, 3-290, 3-291, 3-292, 3-308, 3-314, 3-326, 3-349, 3-351, 3-389, 3-448, 4-4, 4-5

Road decommissioning, 1-16, 2-16, 2-21, 2-41, 2-47, **2-50**, **2-51**, 3-13, 3-15, 3-37, 3-39, 3-40, 3-42, 3-46, 3-66, 3-69, 3-70, 3-71, 3-72, 3-167, 3-224, 3-229, 3-291, 3-292, 3-312, 3-317, 3-318, 3-319

Road maintenance levels, 3-66, 3-67, 3-68

road management, 6-13

Road surfacing, 2-17, 3-66, 3-68, 3-69

Roadless, 1, 6-20

roads, 6-2, 6-4, 6-11, 6-13, 6-15, 6-16, 6-20, 6-22, 6-27

Roads, 1-12, 1-16, 1-19, 1-21, 2-2, 2-7, 2-14, 2-16, 2-17, 2-20, 2-21, 2-24, 2-29, 2-30, 2-31, 2-39, 2-40, 2-41, 2-42, 2-43, 2-44, **2-50**, **2-51**, 2-58, 2-59, 2-60, 3-1, 3-5, 3-9, 3-13, 3-15, 3-16, 3-17, 3-18, 3-20, 3-21, 3-25, 3-30, 3-31, 3-32, 3-36, 3-37, 3-38, 3-39, 3-40, 3-42, 3-46, 3-47, 3-48, 3-49, 3-50, 3-64, 3-65, 3-66, 3-67, 3-68, 3-69, 3-70, 3-71, 3-72, 3-73, 3-74, 3-84, 3-124, 3-132, 3-163, 3-164, 3-167, 3-168, 3-182, 3-183, 3-190, 3-191, 3-192, 3-193, 3-194, 3-195, 3-196, 3-203, 3-210, 3-224, 3-225, 3-226, 3-227, 3-228, 3-229, 3-231, 3-237, 3-241, 3-242, 3-243, 3-245, 3-247, 3-249, 3-255, 3-260, 3-261, 3-263, 3-264, 3-266, 3-267, 3-273, 3-274, 3-276, 3-282, 3-291, 3-292, 3-293, 3-297, 3-299, 3-300, 3-301, 3-306, 3-307, 3-308, 3-312, 3-313, 3-316, 3-317, 3-318, 3-319, 3-326, 3-327, 3-328, 3-332, 3-334, 3-341, 3-342, 3-344, 3-345, 3-350, 3-353, 3-363, 3-364, 3-365, 3-367, 3-371, 3-372, 3-376, 3-377, 3-379, 3-382, 3-392, 3-406, 3-411, 3-418, 3-421, 3-433, 3-441, 3-444, 3-445

Rocky Gap ATV Trail, 3-305, 3-306, 3-307, 3-372, 3-379

ROS. See Recreation, See Recreation, See Recreation, See Recreation, See Recreation

S

Scenery, 1-2, 1-21, 2-20, 2-26, 3-29, 3-45, 3-111, 3-229, 3-296, 3-309, 3-313, 3-328, 3-332, 3-333, 3-340, 3-342, 3-347, 3-350, 3-351, 3-357, 3-361, 3-370, 3-371, 3-372, 3-373, 3-374, 3-375, 3-376, 3-377, 3-378, 3-379, 3-380, 3-433, 4-6, 1, 6-21, 6-26

Scenery Management System, 3-370, 3-371, 3-372, 3-374, 4-6

Scenic Integrity Levels, 1-21, 3-370, 3-371, 3-372, 3-374, 3-375, 3-376, 3-377, 3-379, 3-380

Visual Management System, 3-370

Scenery Management System, 3-370, 1, 6-21, 6-26

Scenic area, 1-2, 1-5, 1-17, 1-20, 2-5, 2-6, 2-14, 2-18, 2-25, 2-27, 2-43, 2-46, 2-54, 3-4, 3-91, 3-126, 3-186, 3-212, 3-307, 3-308, 3-315, 3-323, 3-324, 3-332, 3-354, 3-360, 3-361, 3-364, 3-365, 3-366, 3-367, 3-368, 3-379

School expenditures, 3-427

See

 All terrain vehicles, 1-18, 1-19, 2-5, 2-7, 2-9, 2-11, 2-13, 2-24, 2-28, 2-29, 2-36, 2-38, 2-46, **2-48**, 2-52, 2-58, 3-13, 3-14, 3-38, 3-50, 3-51, 3-57, 3-61, 3-65, 3-243, 3-303, 3-304, 3-305, 3-306, 3-320, 3-322, 3-325, 3-377

silviculture, 6-8

Small whorled pogonia, 1-14, 2-16, 3-209, 3-210, 3-258, 3-289

Snowmobile, 1-17, 1-19, 2-24, 2-29, 2-30, 2-31, **2-48**, 2-52, 3-58, 3-65, 3-249, 3-303, 3-304, 3-305, 3-306, 3-307, 3-308, 3-313, 3-356, 3-357, 3-358, 3-364, 3-365, 3-431, 3-432

Soil compaction, 1-18, 1-21, 2-23, 3-8, 3-10, 3-14, 3-15, 3-18, 3-19, 3-21, 3-38, 3-72, 3-115, 3-189, 3-222, 3-242, 3-373, 3-377

Soil nutrient, 1-11, 3-8, 3-9, 3-10, 3-11, 3-12, 3-13, 3-15, 3-16, 3-17, 3-19, 3-20, 3-36, 3-51, 3-53, 3-88, 3-100, 3-101, 3-102, 3-123, 3-128, 3-175

Soil nutrient limitations, 1-11, 3-93

Special forest product, 1-13, 3-180, 3-385, 3-393, 3-397, 3-398

special uses, 6-16

Species Viability Evaluation, 1-14, 1-16, 2-22, 2-37, 2-57, 3-75, 3-180, 3-181, 3-186, 3-192, 3-205, 3-206, 3-208, 3-254, 3-257, 3-281, 4-5, 4-6, 1

Species with viability concerns, 3-205, 3-213, 3-253, 3-256, 3-260, 3-280, 3-287

Stickney, 3-250, 3-305, 3-306, 3-320, 3-321

Streamflow, 3-23, 3-25, 3-31, 3-33, 3-39, 3-45, 3-46, 3-47, 3-51, 3-72

Sudden oak death, 3-82, 3-103, 3-105

suitable land, 6-2

Suitable land, 2-33, 2-35, 2-56, 3-43, 3-47, 3-200, 3-281, 3-393, 3-395, 3-396

Sulfur dioxide, 3-27, 3-52, 3-53, 3-54, 3-57, 3-58

T

Threatened and endangered species

 Bald eagle, 1-14, 2-16, 2-24, 2-42, 3-180, 3-185, 3-206, 3-209, 3-210, 3-258, 3-288, 3-289, 3-306

 Clubshell, 1-14, 2-16, 2-24, 3-180, 3-207, 3-209, 3-210, 3-211, 3-258, 3-259, 3-284, 3-289

 Indiana bat, 1-14, 2-16, 2-24, 3-209, 3-257, 3-258, 3-288

 Northern bulrush, 1-14, 3-208, 3-209, 3-211, 3-259, 3-289

 Northern riffleshell, 1-14, 2-16, 2-24, 3-180, 3-207, 3-209, 3-210, 3-211, 3-258, 3-259, 3-284, 3-289

 Small whorled pogonia, 1-14, 2-16, 3-209, 3-210, 3-258, 3-289

Timber rattlesnake, 2-3, 2-25, 3-180, 3-184, 3-194, 3-201, 3-202, 3-208, 3-213, 3-228, 3-230, 3-239, 3-240, 3-241, 3-242, 3-254, 3-255, 3-272, 3-273, 3-274, 3-275, 3-282

Timberline ATV Trail, 3-305, 3-306, 3-307

Tionesta Creek, 2-16, 2-18, 3-23, 3-26, 3-27, 3-28, 3-44, 3-50, 3-85, 3-130, 3-182, 3-183, 3-189, 3-209, 3-210, 3-283, 3-284, 3-303, 3-348, 3-349

Tionesta Scenic and Research Natural Area, 2-20, 2-28, 2-54, 3-79, 3-91, 3-181, 3-182, 3-186, 3-188, 3-192, 3-208, 3-212, 3-228, 3-354, 3-366

Tourism, 1-22, 2-18, 2-30, 2-31, 2-43, 3-296, 3-298, 3-312, 3-313, 3-329, 3-357, 3-369, 3-373, 3-400, 3-419, 3-433, 3-437, 3-442, 3-443, 3-447

Tracy Ridge, 1-20, 2-13, 2-19, 2-27, 2-28, 2-33, 2-37, 2-42, 3-194, 3-225, 3-226, 3-302, 3-307, 3-308, 3-323, 3-330, 3-331, 3-334, 3-336, 3-337, 3-338, 3-340, 3-341, 3-343, 3-344, 3-353, 3-355, 3-356, 3-357, 3-358, 3-359

traffic service level, 6-25

trails, 6-4, 6-9, 6-11, 6-15

Trails, 1-2, 1-17, 1-18, 1-19, 2-5, 2-6, 2-7, 2-8, 2-9, 2-11, 2-13, 2-14, 2-17, 2-18, 2-24, 2-25, 2-26, 2-27, 2-28, 2-29, 2-30, 2-31, 2-35, 2-36, 2-38, 2-39, 2-40, 2-41, 2-42, 2-43, 2-44, **2-48**, 2-52, 2-53, 2-58, 3-9, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-19, 3-31, 3-32, 3-36, 3-37, 3-38, 3-40, 3-47, 3-48, 3-49, 3-50, 3-51, 3-61, 3-63, 3-64, 3-65, 3-67, 3-68, 3-72, 3-190, 3-192, 3-193, 3-195, 3-196, 3-213, 3-224, 3-225, 3-227, 3-228, 3-229, 3-232, 3-233, 3-242, 3-243, 3-246, 3-247, 3-249, 3-250, 3-251, 3-252, 3-255, 3-257, 3-260, 3-264, 3-267, 3-268, 3-269, 3-270, 3-274, 3-277, 3-279, 3-292, 3-293, 3-295, 3-296, 3-297, 3-300, 3-301, 3-303, 3-304, 3-305, 3-306, 3-307, 3-308, 3-311, 3-312, 3-313, 3-314, 3-317, 3-318, 3-320, 3-321, 3-322, 3-323, 3-325, 3-326, 3-328, 3-332, 3-333, 3-334, 3-337, 3-341, 3-342, 3-343, 3-344, 3-345, 3-347, 3-350, 3-353, 3-357, 3-358, 3-359, 3-360, 3-361, 3-362, 3-364, 3-365, 3-366, 3-370, 3-371, 3-372, 3-373, 3-377, 3-379, 3-382, 3-398, 3-432, 3-440, 3-441, 3-444, 3-445, 4-1, 4-7

Travel management rule, 3-64, 3-65

Tree mortality, 1-11, 3-92, 3-94, 3-95, 3-102, 3-110, 3-111, 3-145, 3-146, 3-148, 3-171, 3-173, 3-277, 3-389, 3-394

Trout streams, 2-9, 2-11, 2-13, 2-14, 2-17, 2-24, 3-30, 3-42, 3-43, 3-189, 3-190, 3-193, 3-228, 3-251, 3-252, 3-305, 3-395, 3-442

Twin Lakes, 2-20, 3-190, 3-209, 3-250, 3-251, 3-299, 3-302, 3-303, 3-320, 3-321, 3-354, 3-361, 3-362

U

Uneven-aged management, 1-1, 1-9, 1-10, 2-7, 2-8, 2-10, 2-12, 2-39, 2-54, 2-56, 3-11, 3-21, 3-105, 3-111, 3-114, 3-115, 3-116, 3-117, 3-118, 3-119, 3-124, 3-132, 3-133, 3-135, 3-136, 3-138, 3-141, 3-144, 3-145, 3-149, 3-150, 3-151, 3-152, 3-153, 3-154, 3-155, 3-158, 3-159, 3-160, 3-172, 3-214, 3-215, 3-219, 3-220, 3-224, 3-240, 3-244, 3-245, 3-268, 3-278, 3-433

Upland hardwood, 1-7, 1-9, 2-7, 2-8, 2-45, 3-84, 3-86, 3-90, 3-102, 3-117, 3-118, 3-129, 3-132, 3-133, 3-135, 3-144, 3-149, 3-151, 3-152, 3-155, 3-159, 3-160, 3-161, 3-164, 3-165, 3-166, 3-169, 3-179, 3-182, 3-200, 3-363, 3-394

V

Verbeck Island, 3-330, 3-338

W

water quality, 6-3, 6-18

Water quality, 1-19, 1-21, 2-17, 2-24, 3-23, 3-25, 3-27, 3-28, 3-29, 3-31, 3-32, 3-33, 3-35, 3-36, 3-37, 3-38, 3-40, 3-42, 3-43, 3-46, 3-47, 3-48, 3-49, 3-50, 3-51, 3-53, 3-68, 3-72, 3-96, 3-144, 3-181, 3-189, 3-190, 3-191, 3-195, 3-203, 3-204, 3-205, 3-213, 3-221, 3-226, 3-251, 3-252, 3-253, 3-279, 3-288, 3-289, 3-322, 3-326, 3-344, 3-351, 3-352, 3-431, 3-437

Water resources, 2-24, 3-10, 3-25, 3-31, 3-32, 3-37, 3-38, 3-40, 3-41, 3-46, 3-48, 3-49, 3-50, 3-72, 3-75, 3-223, 3-349, 3-434, 4-4

Watershed, 2-14, 2-15, 2-17, 2-24, 3-11, 3-22, 3-23, 3-24, 3-25, 3-27, 3-28, 3-29, 3-31, 3-32, 3-33, 3-36, 3-38, 3-39, 3-41, 3-42, 3-43, 3-44, 3-45, 3-46, 3-48, 3-49, 3-50, 3-51, 3-69, 3-115, 3-181, 3-182, 3-193, 3-200, 3-208, 3-222, 3-239, 3-252, 3-268, 3-270, 3-272, 3-299, 3-314, 3-329, 3-341, 3-345, 3-349, 3-352, 3-353, 3-355, 3-358, 3-362, 3-392, 3-395, 3-420, 3-447, 3-448, 4-3

watersheds, 6-21, 6-26

Westline, 2-9, 3-305, 3-308, 3-320, 3-321, 3-372, 3-379

wetland, 6-7

Wetland, 2-4, 3-23, 3-26, 3-29, 3-30, 3-31, 3-32, 3-33, 3-35, 3-36, 3-37, 3-38, 3-40, 3-41, 3-42, 3-47, 3-48, 3-49, 3-50, 3-51, 3-184, 3-188, 3-189, 3-192, 3-211, 3-213, 3-221, 3-222, 3-254, 3-256, 3-260, 3-282, 3-285, 3-287, 3-289, 3-291, 3-292, 3-342, 3-351, 3-367

White-tailed deer, 1-7, 1-9, 1-11, 1-14, 1-15, 2-5, 2-15, 2-22, 2-32, 2-33, 2-34, 2-39, 3-26, 3-73, 3-78, 3-82, 3-87, 3-88, 3-91, 3-92, 3-93, 3-94, 3-95, 3-106, 3-108, 3-110, 3-111, 3-112, 3-114, 3-116, 3-117, 3-119, 3-121, 3-123, 3-124, 3-127, 3-129, 3-138, 3-139, 3-141, 3-142, 3-143, 3-145, 3-146, 3-147, 3-150, 3-152, 3-154, 3-156, 3-158, 3-162, 3-164, 3-165, 3-166, 3-167, 3-169, 3-172, 3-173, 3-175, 3-180, 3-182, 3-184, 3-188, 3-189, 3-204, 3-217, 3-218, 3-244, 3-245, 3-248, 3-249, 3-250, 3-262, 3-278, 3-279, 3-289, 3-341, 3-378, 3-433

Wild and Scenic River, 1-2, 1-5, 1-17, 1-20, 2-6, 2-8, 2-9, 2-12, 2-13, 2-14, 2-18, 2-25, 2-36, 2-42, 2-44, 2-46, 3-130, 3-152, 3-211, 3-316, 3-329, 3-333, 3-338, 3-344, 3-345, 3-348, 3-349, 3-350, 3-352, 3-354, 3-355, 3-364, 3-374, 3-377, 3-395, 3-422, 4-8, 1

wilderness, 6-11, 6-15, 6-27

Wilderness, 1-2, 1-5, 1-12, 1-16, 1-17, 1-18, 1-20, 1-22, 2-3, 2-5, 2-6, 2-7, 2-9, 2-11, 2-13, 2-14, 2-16, 2-17, 2-19, 2-24, 2-27, 2-28, 2-30, 2-31, 2-32, 2-33, 2-35, 2-36, 2-40, 2-42, 2-44, 2-46, 2-48, 2-53, 2-58, 3-4, 3-30, 3-42, 3-43, 3-52, 3-126, 3-130, 3-181, 3-192, 3-193, 3-194, 3-200, 3-213, 3-225, 3-226, 3-228, 3-229, 3-251, 3-252, 3-253, 3-267, 3-296, 3-297, 3-299, 3-300, 3-305, 3-308, 3-309, 3-310, 3-315, 3-317, 3-319, 3-321, 3-322, 3-324, 3-329, 3-330, 3-331, 3-332, 3-333, 3-334, 3-335, 3-336, 3-337, 3-339, 3-340, 3-342, 3-343, 3-344, 3-346, 3-352, 3-353, 3-354, 3-355, 3-356, 3-357, 3-358, 3-359, 3-360, 3-361, 3-363, 3-368, 3-374, 3-384, 3-395, 3-396, 3-397, 3-413, 3-414, 3-431, 3-432, 3-433, 3-446, 4-3, 4-8, 5-4

Wilderness Study Area, 1-2, 1-5, 1-17, 1-20, 2-3, 2-6, 2-11, 2-13, 2-14, 2-28, 2-40, 2-44, 2-46, 2-53, 3-126, 3-130, 3-213, 3-225, 3-229, 3-252, 3-315, 3-319, 3-321, 3-324, 3-330, 3-331, 3-332, 3-333, 3-335, 3-336, 3-337, 3-339, 3-340, 3-343, 3-354, 3-355, 3-359, 3-363, 3-374, 3-384, 3-395, 3-396, 3-397, 3-413

Wilderness study areas

Allegheny Front, 1-20, 2-13, 2-19, 2-27, 2-28, 2-33, 3-22, 3-23, 3-25, 3-44, 3-50, 3-194, 3-225, 3-226, 3-228, 3-252, 3-330, 3-331, 3-336, 3-337, 3-338, 3-340, 3-341, 3-343, 3-344, 3-353, 3-355, 3-356, 3-359

Chestnut Ridge, 1-20, 2-11, 2-13, 2-19, 2-27, 2-28, 3-194, 3-225, 3-227, 3-229, 3-266, 3-300, 3-321, 3-322, 3-328, 3-331, 3-334, 3-336, 3-337, 3-342, 3-343, 3-344

Minister Valley, 1-20, 2-3, 2-9, 2-11, 2-13, 2-19, 2-27, 2-28, 3-299, 3-300, 3-303, 3-318, 3-319, 3-328, 3-330, 3-331, 3-334, 3-335, 3-336, 3-337, 3-338, 3-341, 3-342, 3-343, 3-344

Tracy Ridge, 1-20, 2-13, 2-19, 2-27, 2-28, 2-33, 2-37, 2-42, 3-194, 3-225, 3-226, 3-302, 3-307, 3-308, 3-323, 3-330, 3-331, 3-334, 3-336, 3-337, 3-338, 3-340, 3-341, 3-343, 3-344, 3-353, 3-355, 3-356, 3-357, 3-358, 3-359

wildlife habitat, 6-4, 6-13

Wildlife habitat, 1-9, 2-20, 2-32, 2-38, 2-40, 2-41, 3-42, 3-45, 3-84, 3-107, 3-109, 3-110, 3-112, 3-120, 3-125, 3-144, 3-150, 3-151, 3-162, 3-182, 3-183, 3-187, 3-194, 3-212, 3-214, 3-216, 3-224, 3-225, 3-227, 3-250, 3-274, 3-295, 3-308, 3-326, 3-340, 3-342, 3-369, 3-376, 3-396, 3-431, 3-437, 3-444

Willow Creek ATV Trail, 3-305, 3-306, 3-320

Windstorms, 3-78, 3-93, 3-126, 3-174, 3-183, 3-268, 3-273, 3-277

This page intentionally left blank.

This page intentionally left blank.

Please recycle this document when it is ready to be discarded.

