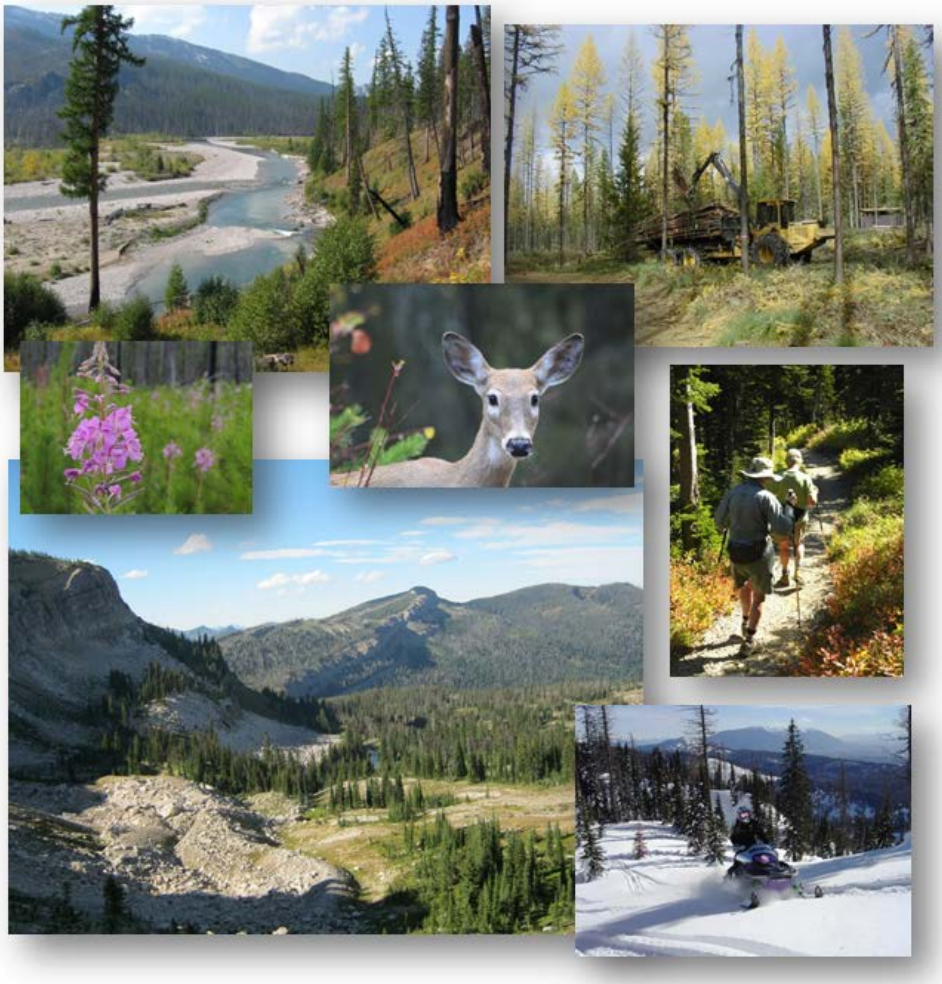
United States Department of Agriculture

Draft Environmental Impact Statement
Volume 2: Revised Forest Plan

Flathead National Forest



Forest Service

May 2016

"…the greatest good for the greatest number in the long run." –Gifford Pinchot, 1st Chief of the Forest Service, 1905

Volume 2: Draft Environmental Impact Statement for the Revised Forest Plan for the Flathead National Forest

Lead Agency:	**USDA Forest Service**
Responsible Official:	Chip Weber, Forest Supervisor 650 Wolfpack Way Kalispell, MT 59901 406-758-5204
For Information Contact:	Joe Krueger, Forest Plan Revision Planning Team Lead 650 Wolfpack Way Kalispell, MT 59901 406-758-5243

Abstract: This is volume 2 of the draft environmental impact statement (DEIS) document containing analysis of four alternatives developed for programmatic management of the 2.4 million acres administered by the Flathead National Forest.

Comments: Comments on this DEIS must be received or postmarked within 90 days of the Environmental Protection Agency's publication of the Notice of Availability in the Federal Register. It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the final environmental impact statement. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

The decision to approve the revised forest plan for the Flathead National Forest and the amendments for the Helena, Lewis and Clark, Kootenai, and Lolo National Forests will be subject to the objection process identified in 36 CFR Part 219 Subpart B (219.50 to 219.62). Only those individuals and entities who have submitted substantive formal comments related to the Flathead National Forest plan revision and the four amendments during the opportunities provided for public comment, will be eligible to file an objection (36 Code of Federal Regulations (CFR) 219.53(a)).

Send comments to: Flathead National Forest Supervisor's Office, Attn: Forest Plan Revision, 650 Wolfpack Way, Kalispell, Montana 59901. Electronic comments may be sent to http://www.fs.usda.gov/project/?project=46286.

Date Comments Must Be Received: September 26, 2016

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

Flathead National Forest photo captions (clockwise from upper left):

- South Fork of the Flathead River, Spotted Bear Ranger District
- Forwarder working on the Paint Emery Resource Mgt. Project, Hungry Horse –Glacier View Ranger District
- Two hikers
- Snowmobile
- View taken on the way to Pentagon Cabin in the Bob Marshall Wilderness (photo by Peter Borgesen)
- Fireweed
- Whitetail deer (photo by John Littlefield)

Table of Contents

Table of Contents i

List of Tables iv

List of Figures vi

Chapter 1. refer to Volume 1 of the DEIS 1

Chapter 2. refer to Volume 1 of the DEIS 1

Chapter 3. Affected Environment and Environmental Consequences 1

3.1 Physical and Biological Ecosystems—Refer to Volume 1 of the DEIS for this section of chapter 3 1

3.2 Soils, Watersheds, Riparian and Aquatic Ecosystems 1

3.3 Terrestrial Ecosystems and Vegetation 1

3.4 Native Plant Species 1

3.5 Non-native Invasive Plants 1

3.6 Wildlife 1

3.7 Fire and Fuels Management 1

3.8 Air Quality 1

Human Uses, Benefits, and Designations of the Forest 3

3.9 Recreation and Access 3

3.9.1 Legal and administrative framework 3
3.9.2 Key indicators 5
3.9.3 Methodology and analysis process 5
3.9.4 Affected environment (existing condition) 6
3.9.5 Environmental consequences 14

3.10 Scenery 26

3.10.1 Legal and administrative framework 26
3.10.2 Key indicators 26
3.10.3 Methodology and analysis process 26
3.10.4 Affected environment (existing condition) 27
3.10.5 Environmental consequences 30

3.11 Infrastructure 34

3.11.1 Introduction 34
3.11.2 Legal and administrative framework 34
3.11.3 Methodology and analysis process 35
3.11.4 Affected environment (existing condition) 35
3.11.5 Environmental consequences 38

3.12 Lands and Special Uses 43

3.12.1 Introduction 43
3.12.2 Legal and administrative framework 44
3.12.3 Key indicators 46
3.12.4 Methodology and analysis process 46
3.12.5 Affected environment (existing condition) 47

3.12.6 Environmental consequences 49
3.12.7 Cumulative effects 50
3.12.8 Effects determination 51

3.13 Designated Wilderness 51
3.13.1 Introduction 51
3.13.2 Legal and administrative framework 52
3.13.3 Key indicator 52
3.13.4 Methodology and analysis process 52
3.13.5 Affected environment (existing condition) 53
3.13.6 Environmental consequences 54

3.14 Recommended Wilderness 56
3.14.1 Introduction 56
3.14.2 Legal and administrative framework 56
3.14.3 Key indicators 56
3.14.4 Methodology and analysis process 57
3.14.5 Affected environment (existing condition) 58
3.14.6 Environmental consequences 59

3.15 Inventoried Roadless Areas 70
3.15.1 Introduction 70
3.15.2 Legal and administrative framework 70
3.15.3 Key indicators 70
3.15.4 Methodology and analysis process 70
3.15.5 Affected environment (existing condition) 71
3.15.6 Environmental consequences 72

3.16 Wild and Scenic Rivers 78
3.16.1 Legal and administrative framework 78
3.16.2 Key indicator 78
3.16.3 Methodology and analysis process 79
3.16.4 Affected environment (existing condition) 79
3.16.5 Environmental consequences 81

3.17 National Scenic Trails 83
3.17.1 Legal and administrative framework 83
3.17.2 Indicators, methodology and analysis process 83
3.17.3 Affected environment (existing condition) 84
3.17.4 Environmental consequences 85

3.18 Special Areas 87
3.18.1 Introduction 87
3.18.2 Legal and administrative framework 87
3.18.3 Methodology and analysis process 87
3.18.4 Affected environment (existing condition) 88
3.18.5 Environmental consequences 92
3.18.6 Cumulative effects 93

3.19 Research Natural Areas, Coram Experimental Forest, and Miller Creek Demonstration Forest 94
3.19.1 Introduction 94
3.19.2 Legal and administrative framework 94
3.19.3 Key indicator 94
3.19.4 Methodology and analysis process 94
3.19.5 Affected environment (existing condition) 95
3.19.6 Environmental consequences 98

3.19.7 Cumulative effects 100

Production of Natural Resources....101

3.20 Forest Products: Timber 101
3.20.1 Legal and administrative framework 101
3.20.2 Key indicators 102
3.20.3 Methodology and analysis process....102
3.20.4 Affected environment (existing condition)....103
3.20.5 Environmental consequences....107
3.20.6 Cumulative effects 118

3.21 Other Forest Products, including Huckleberries 119
3.21.1 Legal and administrative framework 119
3.21.2 Methodology and analysis process....120
3.21.3 Affected environment (existing condition)....120
3.21.4 Environmental consequences....122
3.21.5 Cumulative effects 125
3.21.6 Effects summary 126

3.22 Mineral Resources....126
3.22.1 Introduction 126
3.22.2 Legal and administrative framework 128
3.22.3 Key indicators 132
3.22.4 Methodology and analysis process....132
3.22.5 Affected environment (existing condition)....133
3.22.6 Environmental consequences....135

3.23 Livestock Grazing....139
3.23.1 Legal and administrative framework 140
3.23.2 Key indicators 142
3.23.3 Methodology and analysis process....142
3.23.4 Affected environment (existing condition)....144
3.23.5 Environmental consequences....147
3.23.6 Cumulative effects 155
3.23.7 Effects determination 156

Economic, Social, and Cultural Environment....157

3.24 Cultural and Historical Resources....157
3.24.1 Legal and administrative framework 157
3.24.2 Key indicators 159
3.24.3 Methodology and analysis process....160
3.24.4 Affected environment (existing condition)....160
3.24.5 Environmental consequences....161
3.24.6 Cumulative effects 165
3.24.7 Effects determination 165

3.25 American Indian Rights and Interests....165
3.25.1 Introduction 165
3.25.2 Legal and administrative framework 166
3.25.3 Key indicator 169
3.25.4 Methodology and analysis process....169
3.25.5 Affected environment (existing condition)....170
3.25.6 Environmental consequences....170
3.25.7 Cumulative effects 173
3.25.8 Effects determination 173

3.26 Benefits and Beneficiaries (Social and Economic Environment) *174*
3.26.1 Introduction 174
3.26.2 Legal and administrative framework 174
3.26.3 Evaluation framework: economic and social benefits 176
3.26.4 Key indicators 177
3.26.5 Methodology and analysis process 178
3.26.6 Affected environment (existing condition) 178
3.26.7 Environmental justice 201
3.26.8 Environmental consequences 201

Literature Cited *213*

Index *283*

List of Tables

Table 1. Existing summer and winter recreation opportunity spectrum settings on the Forest 8
Table 2. Forest Service developed recreation sites on the Forest 8
Table 3. Number of developed recreation sites (NCDE definition) by categories on the Forest in the primary conservation area 9
Table 4. Overnight developed sites (NCDE definition) capacity on the Forest in the primary conservation area 10
Table 5. Recreation visits, wilderness visits and percentage of visitors living within 100 miles on the Forest 11
Table 6. Top 10 activities by participation rate on the Forest 2010 and 2005 12
Table 7. Miles of open roads and motorized trails, within the primary conservation area and zone 1 13
Table 8. Allowed summer trail use on the Flathead National Forest in miles 13
Table 9. Miles and acres of over-snow routes and areas within the Forest by season allowed[1] 14
Table 10. Grizzly Bear subunits and the estimated miles wheeled motorized trails estimated needed to close to meet 19-19-68. 15
Table 11. Current capacity of developed recreation sites in the primary conservation area on the Flathead National Forest 15
Table 12. Desired summer recreation opportunity spectrum classes on the Forest by alternative 18
Table 13. Desired winter recreation opportunity spectrum classes on the Flathead National Forest by alternative 18
Table 14. Focused recreation areas (management area 7) by alternative 19
Table 15. Summary of suitability of wheeled motorized or motorized over-snow vehicle use by MAs 21
Table 16. Acres and forest wide percent of motorized over-snow areas and corridors within the Forest by season allowed by alternative 22
Table 17. Cross-walk between visual quality objective and scenery management system terms 27
Table 18. Acres and percent of forest within each scenic attractiveness rating on the Forest 29
Table 19. Scenic integrity levels and pictorial examples 29
Table 20. Existing scenic integrity of the Forest 30
Table 21. Scenic integrity objectives (and corresponding visual quality objectives) for alternative A in percent of Forest 31
Table 22. Scenic integrity objectives in percent of Forest for alternative B 31
Table 23. Scenic integrity objectives of the Flathead National Forest in percent of forest for alternative C .. 32
Table 24. Scenic integrity levels of the Flathead National Forest in percent of forest for alternative D 32
Table 25. Percentage of NFS roads by maintenance level grouping on the Forest, primary conservation area (PCA) and zone 1 37
Table 26. Miles of NFS roads open to the public by maintenance level on the Forest, primary conservation area (PCA) and zone 1 37

Table 27. Miles of NFS roads closed to the public by maintenance level on the Forest, primary conservation area (PCA) and zone 1 ... 37
Table 28. Miles of NFS roads receiving maintenance, percentage of passenger car system and high clearance car system receiving maintenance, on the Forest for the last five years ... 37
Table 29. Miles of NFS and non-NFS road decommissioned from 2004 to 2015 on the Forest ... 38
Table 30. List of grizzly bear subunits and the estimated miles of NFS road closures to meet forest plan direction ... 39
Table 31. Summary of travel management actions needed to meet motorized access direction in all subunits, unless amended. ... 39
Table 32. Recommended Wilderness areas and acres in alternative A ... 59
Table 33. Indicators for alternative A ... 59
Table 34. Recommended wilderness areas and acres in alternative B ... 61
Table 35. Indicators for Alternative B ... 61
Table 36. Recommended wilderness areas and acres in alternative C ... 63
Table 37. Indicators for recommended wilderness for Alternative C ... 63
Table 38. Indicators for recommended wilderness for alternative D ... 65
Table 39. Percentage of largest MA groupings within inventoried roadless areas (IRAs) on the Forest ... 71
Table 40. Summary of wheeled motorized trails, motorized over-snow vehicle motorized areas, motorized over-snow vehicle in acres and roads within the inventoried roadless areas on the Forest ... 71
Table 41. Indicators for alternative A ... 72
Table 42. Indicators for alternative B ... 73
Table 43. Indicators for alternative C ... 74
Table 44. Indicators for alternative D ... 75
Table 45. List of eligible wild and scenic rivers, their segments, potential classification, outstandingly remarkable values and length ... 80
Table 46. Existing and proposed special areas on the Forest ... 88
Table 47. Established research natural areas (RNAs) on the Forest, their establishment date and acres ... 95
Table 48 Timber suitability for the 1986 Plan ... 103
Table 49. Annual volume of timber processed by tree size class (excluding pulpwood) for the Flathead National Forest timber processing area, 2011. ... 105
Table 50. Annual total capacity and capability* to process trees by size class (excluding pulpwood) for the Forest timber processing area, 2011. ... 105
Table 51. Timber suitability by alternative ... 109
Table 52. Average annual projected timber sale quantities by alternative — decades 1 and 2 with reasonably foreseeable budget ... 111
Table 53. Average annual projected timber sale quantities by alternative — decades 1 and 2 with no budget limitation ... 113
Table 54. Average annual acres treated by treatment type by alternative — decades 1 and 2 – reasonably foreseeable budget ... 115
Table 55. Average annual acres treated by treatment type by alternative — decades 1 and 2 –unlimited budget ... 115
Table 56. Acres suitable for timber production, percent scheduled for harvest, and first decade harvest within inventoried roadless areas, with reasonably foreseeable budget ... 117
Table 57. Acres suitable for timber production, percent scheduled for harvest, and first decade harvest within inventoried roadless areas, with unlimited budget ... 117
Table 58. Acres of MAs where commercial use of special forest products is and is not allowed by alternative ... 122
Table 59. Acres of MAs where personal use of special forest products is and is not allowed by alternative 122
Table 60. Acres within MAs designated suitable for timber production, reflecting the area with higher potential for opportunities to gather special forest products from roads ... 123
Table 61. Acres suitable for timber production by alternative, and expected annual average timber harvest outputs over the next two decades ... 124
Table 62. Acres suitable for mineral leasing across all alternatives ... 136

Table 63. Forest in-service mineral material use for fiscal year 2012 136
Table 64. Forest in-service mineral material use for fiscal year 2013 136
Table 65. Acres suitable for salable mineral disposal across all alternatives 137
Table 66: Resource indicators and measures for assessing effects from livestock grazing 142
Table 67. Flathead National Forest range allotments and their respective locations within the NCDE grizzly bear management zones 145
Table 68. Key indicators for cultural resources 160
Table 69. Indicators used to measure differences among alternatives 169
Table 70. Contribution to social and economic sustainability 177
Table 71. Total population, and percent of the total population by race, 2011* 183
Table 72. Age distribution of residents in analysis area, 2000 and 2011 183
Table 73. Population, economy and land summary 186
Table 74. Poverty level by age & family type in Montana and by county, 2011* 191
Table 75. Educational attainment percent of total in US, Montana, and by county in region 192
Table 76. Indicators of health and safety levels in the analysis area related to land management 193
Table 77. Life expectancy at birth 194
Table 78. Labor Income by resource by alternative (average annual, in thousands of 2014 U.S. dollars) 202
Table 79. Employment by resource by alternative (average annual, in thousands of 2014 U.S. dollars) 202
Table 80. State and local tax impact by resource by alternative (average annual, in thousands of 2014 U.S. dollars) 203

List of Figures

NOTE: Figures that are preceded by 1 are within appendix 1 of this DEIS, and if preceded by B are in appendix B of the forest plan. Most of the figures in appendix 1 and appendix B are on the cd that accompanies this draft EIS. The figures that have been reproduced and can be found at the back of this volume are figures 1-01 thru 1-04, forestwide maps of management areas by alternative.

Figure 1. Illustration of the recreation opportunity spectrum settings 6
Figure 2. Percent visits by primary activity in 2010 on the Flathead 12
Figure 3. Cut and sold volumes for the Forest: 1986-2012 107
Figure 4. Counties in the analysis area 180
Figure 5. Population change in counties in the analysis area (2000–2010) 181
Figure 6. Population by census tracts in the analysis area (2009–2013) 182
Figure 7. Native American population by census tracts in the analysis area (2009–2013) 182
Figure 8. Percent of population, 65 and over, by census tract. 184
Figure 9. Population (2014) by county 185
Figure 10. Unemployment rate by county 185
Figure 11. Non-labor income by county 186
Figure 12. Federal land ownership by county 188
Figure 13. Private employment sectors by county 188
Figure 14. Percent employment represented by industries that support travel & tourism vs. timber, in counties within the analysis area 190
Figure 15. Timber vs. non-timber private employment in counties within the analysis area 190
Figure 16. Travel and tourism vs. non-travel private employment in counties within the analysis area 191
Figure 17. Federal land payments by source and county 200

Chapter 1. refer to Volume 1 of the DEIS

Chapter 2. refer to Volume 1 of the DEIS

Chapter 3. Affected Environment and Environmental Consequences

3.1 Physical and Biological Ecosystems—Refer to Volume 1 of the DEIS for this section of chapter 3

3.2 Soils, Watersheds, Riparian and Aquatic Ecosystems

3.3 Terrestrial Ecosystems and Vegetation

3.4 Native Plant Species

3.5 Non-native Invasive Plants

3.6 Wildlife

3.7 Fire and Fuels Management

3.8 Air Quality

Page Intentionally Blank

Human Uses, Benefits, and Designations of the Forest

This section includes the following resources:

- Sustainable recreation and access
- Scenery
- Infrastructure
- Lands and special uses
- Wilderness and inventoried roadless areas
- Wild and scenic rivers
- Special areas.

3.9 Recreation and Access

3.9.1 Legal and administrative framework

Law and Executive Orders

Federal law

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended): This act authorizes the establishment of national forests.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L.86-517, 74 Stat.215): This act provides direction to the NFS lands to provide access and recreation opportunities. The act states, "The policy of Congress is that national forests are established and administered for outdoor recreation…"

Term Permit Act of March 4, 1915 (P.L. 63-293, Ch. 144, 38 Stat. 1101, as amended; 16 U.S.C. 497): This act provides direction to the NFS lands to authorize occupancy for a wide variety of uses through permits not exceeding 30 years.

National Forest Roads and Trails Act of October 13, 1964 (P.L. 88-657, 78 Stat. 1089, as amended): This act declared that an adequate system of roads and trails be constructed and maintained to meet the increasing demand for recreation and other uses. This act authorizes road and trail systems for the national forests. It authorizes granting of easements across NFS lands, construction and financing of maximum economy roads (Forest Service Manual 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

Land and Water Conservation Fund Act of 1965 (P.L. 88-578, 78 Stat. 897 as amended; 16 U.S.C. 460l-4(note); 460l-4 thru 6a, 460l-7 thru 460l-10, 460l-10a-d, 460l-11): "The purposes of this act are to assist in preserving, developing, and assuring accessibility to all citizens of the United States of America…such quality and quantity of outdoor recreation resources…providing funds for:" 1. States for acquisition, planning, and development of recreation facilities and; 2. Federal acquisition and development of certain lands and other areas.

Architectural Barriers Act of August 12, 1968 (P.L. 90-480, 82 Stat. 718 51 U.S.C. 4151-4154, 4154a, 4155-4157): This act establishes additional requirements to ensure that buildings, facilities, rail passenger cars, and vehicles are accessible to individuals with disabilities. It covers architecture and design, transportation, and communication elements of recreational site planning and development.

National Trails System Act of October 2, 1968 (P.L. 90-543, 82 Stat.919, as amended): This act establishes the National Trails System and authorizes planning, right-of-way acquisition, and construction of trails established by Congress or the Secretary of Agriculture.

Rehabilitation Act of September 26, 1973 (P.L. 93-112, Title V, 87 Stat. 390, as amended; 29 U.S.C. 791, 793-794, 794a, 794b): This act requires that programs and activities conducted by federal agencies and by entities that receive funding from, or operate under a permit from, federal agencies provide an equal opportunity for individuals with disabilities to participate in an integrated setting, as independently as possible. The only exception to the requirement is when the program would be fundamentally altered if changes were made solely for the purpose of accessibility.

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 (P.L. 93-378, 88 Stat. 476, as amended): This act declares (per Sec. 10) that "…the installation of a proper system of transportation to service the NFS ….shall be carried forward in time to meet anticipated needs on an economical and environmentally sound basis…"

Federal Land Policy and Management Act of October 21, 1976 (P.L. 94-579, 90 Stat. 2742, as amended): This act declares (per Sec. 102) that "…the public lands be managed in a manner that…will provide for outdoor recreation and human occupancy and use."

Ski Fees, Omnibus Parks and Public Lands Management Act of November 12, 1996 (Pub. L. 104-333, div. I, Title VII, Sec. 701, 110 Stat. 4182; 16 U.S.C. 497c): Section 701 of this act:

- Establishes a system to calculate fees for ski area permits issued under the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b);
- Provides for holders of ski area permits issued under other authorities to elect this permit fee system (Forest Service Handbook 2709.11, sec. 38.03a);
- Includes provisions concerning compliance with NEPA when issuing permits for existing ski areas (Forest Service Manual 2721.61f and Forest Service Handbook 2709.11, sec. 41.61b); and
- Withdraws leasable and locatable minerals, subject to valid existing rights (Forest Service Handbook 2709.11, sec. 41.61c).

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (P. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): This act provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure, implement stewardship objectives that enhance forest ecosystems, and restore and improve land health and water quality.

Federal Lands Recreation Enhancement Act of December 8, 2004 (P.L. 108-447, as amended): This act gives the Secretaries of Agriculture and Interior the authority to establish, modify, charge, and collect recreation fees at federal recreational lands where a certain level of amenities have been developed.

Executive orders

Executive Order 12862: Setting Customer Service Standards requires information about quantity and quality of recreation visits for national forest plans.

Executive Order 11644 (as amended): Establishes policy and procedure "…that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands."

3.9.2 Key indicators

- Acres of desired summer and winter recreation opportunity spectrum settings
- Desired summer and winter recreation opportunity spectrum settings
- Acres of suitable/not suitable for motorized over-snow vehicle use
- Acres and miles of late-season motorized over-snow vehicle use (outside of denning season)
- Acres and miles of open year-long to motorized over-snow vehicle use.

3.9.3 Methodology and analysis process

For comparison purposes, the desired recreational opportunity spectrum for summer and winter was mapped across the forest for each alternative. The methodology for mapping recreation opportunity spectrum for each alternative follows Forest Service handbook direction. Each alternative was then analyzed for the total number of acres and percentage of the desired recreation opportunity spectrum settings on the Forest.

For comparison purposes, the total number of acres where motorized over-snow vehicle use would be suitable, and where late-season motorized over-snow vehicle use would be suitable was analyzed for each alternative. A motorized over-snow vehicle suitability map was completed for each alternative to reflect where motorized use is suitable. A geographic information system was then used to calculate the number of acres suitable for each alternative.

Where **wheeled motor-vehicle use** is discussed in this DEIS relative to road, trail, and area or cross-country travel, it includes all types of motor vehicles as defined at 36 CFR 212.1 **except** over-snow vehicles. This generally indicates wheeled motor vehicles such as automobiles, four-wheel drive vehicles, and off-highway vehicles (except over-snow), but also includes those vehicles that have the driving wheels moving inside endless tracks (or are capable of such conversion) when operating outside snow-covered ground conditions. **Over-snow vehicles** are defined as motor vehicles designed for use over snow that run on a track or tracks and/or a ski or skis, **while in use over snow** (36 CFR 212.1). Effects of these two recreation opportunities are analyzed as separate activities in this document and are referred to as either "wheeled motor vehicle use" or "motorized over-snow vehicle use". When the term motorized access or motorized recreation is used, it refers to all vehicles - both wheeled motor vehicles and motorized over-snow vehicle use. Mechanized or mechanical transport is bicycles, wagons and carts.

Information sources

Much of recreation data comes from the Forest Service infrastructure database, termed Infra. This database is a collection of web-based data entry forms, reporting tools, and mapping tools (a geographic information system that enables forests to manage and report accurate information about

their inventory of constructed features and land units). Use of the geographic information system allows us to visualize, analyze, interpret, and understand data to reveal relationships and patterns.

Analysis area

The geographic scope of the analysis is the lands administered by the Flathead National Forest (hereinafter referred to as the "Forest"). All lands within the Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years).

3.9.4 Affected environment (existing condition)

Recreation setting and access

People choose a specific setting for recreational activities in order to achieve a desired set of experiences. For example, camping in a large undeveloped area with few facilities offers a sense of solitude, challenge, and self-reliance. In contrast, camping in a setting having easy access and developed facilities such as toilets and tables, offers more comfort, security, and social opportunities. A goal of the Forest Service is to provide opportunities for the recreationist to obtain satisfying recreational experiences through choices in both the types of settings and activities offered. The Forest Service utilizes a framework called the recreation opportunity spectrum, pictured in figure 1, to describe different settings across the landscape and attributes associated with those settings. The Forest Service defines a recreation opportunity setting as the combination of physical, biological, social, and managerial conditions that give value to a place. Thus, an opportunity includes qualities provided by nature (vegetation, landscape, topography, scenery), qualities associated with recreational use (levels and types of use), and conditions provided by management (developments, roads, regulations).

The recreation opportunity spectrum is the framework for settings and opportunities and is determined, in part, by the suitability by MA for motorized and non-motorized vehicles use. Travel management decisions are separate, project-level decisions that determine the specific areas and routes for motorized recreation consistent with areas identified in the plan as suitable for motorized recreation use.

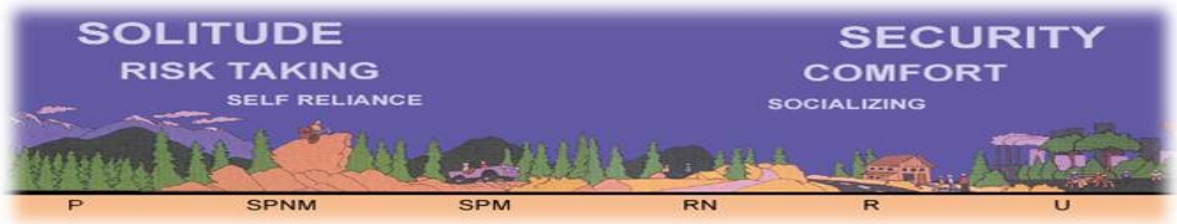


Figure 1. Illustration of the recreation opportunity spectrum settings

The recreation opportunity spectrum has six distinct classes in a continuum to describe settings that range from highly modified and developed to primitive and undeveloped (USDA FS 1986). There are five recreation opportunity spectrum classes that apply to the Flathead National Forest: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural. There are no urban recreation opportunity spectrum classes on the forest. The recreation opportunity classes are briefly described as follows:

- **Primitive** – this setting is large, remote, wild, and predominately unmodified landscapes. There is no motorized activity and little probability of seeing other people. Primitive settings are

managed for quiet solitude away from roads, people, and development. There few, if any facilities or developments. Most of the primitive settings coincide with designated wilderness boundaries and recommended wilderness areas.

- **Semi-primitive non-motorized** – the semi-primitive non-motorized settings include areas of the forest managed for non-motorized use. Mountain bikes and other mechanized equipment are often present. Rustic facilities are present for the primary purpose of protecting the natural resources of the area. These settings are not as vast or remote as the primitive settings, but offer opportunities for exploration, challenge, and self-reliance.
- **Semi-primitive motorized** – This setting is managed for backcountry motorized use on designated routes. Routes are designed for off highway vehicles and other high clearance vehicles. This setting offers visitors motorized opportunities for exploration, challenge, and self-reliance. Mountain bikes and other mechanized transport are also sometimes present. Rustic facilities are present for the primary purpose of protecting the natural resources of the area or providing portals to adjacent areas of primitive, or semi-primitive non-motorized areas.
- **Roaded natural** – This setting is managed as natural appearing with nodes and corridors of development that support higher concentrations of use, user comfort, and social interaction. The road system is generally well defined in this setting and can typically accommodate sedan travel. System roads also provide access to other recreation opportunity spectrum settings of semi-primitive motorized, semi-primitive non-motorized, and primitive areas.
- **Rural** – This setting represents the most developed recreation sites and modified natural settings. Facilities are designed primarily for user comfort and convenience.

The existing recreation opportunity spectrum is based on modeling of travel routes and terrain. Recreation opportunity spectrum classes on the forest were mapped for summer and winter seasons to address the change in motorized and non-motorized opportunities during these seasons.

Summer recreation opportunity spectrum

As shown in table 1, the three largest summer recreation opportunity spectrum classes on the forest are primitive (48 percent), roaded natural (25 percent) and semi-primitive non-motorized (24 percent). Refer to figure 1-48 for a map of the existing summer recreation opportunity spectrum map.

Combining the two non-motorized classes (primitive and semi-primitive non-motorized), there is 72 percent of the forest in a non-motorized setting. This is primarily because of three designated wilderness areas (Bob Marshall, Great Bear and Mission Mountains) and large amounts of inventoried roadless areas (478,757 acres) on the forest. Combining the motorized classes (semi-primitive motorized and roaded natural and rural) there is 28 percent of the forest in a motorized setting.

Winter recreation opportunity spectrum

As shown in table 1, the three largest winter recreation opportunity spectrum settings on the forest are primitive (48 percent), semi-primitive motorized (34 percent) and semi-primitive non-motorized (14 percent). Refer to figure 1-49 for a map of the existing winter recreation opportunity spectrum map.

As shown in table 1, there is a shift in recreation opportunity spectrum settings between summer and winter. The semi-primitive non-motorized and roaded natural settings shift to semi-primitive

motorized. Roaded natural decreases because most forest roads are not plowed, and therefore not open in the winter, providing a semi-primitive motorized setting. Semi-primitive non-motorized decreases because there are more areas open to motorized over- snow vehicles across the forest.

Combining the two non-motorized classes (primitive and semi-primitive non-motorized), there is 62 percent of the forest in a non-motorized setting. Combining the motorized classes (semi-primitive motorized and roaded natural and rural) there is 38 percent of the forest is a motorized setting.

Table 1. Existing summer and winter recreation opportunity spectrum settings on the Forest

ROS	Primitive (percent)	Semi-primitive non-motorized (percent)	Semi-primitive motorized (percent)	Roaded Natural (percent)	Rural (percent)
Summer	48	24	3	25	<1
Winter	48	14	34	4	<1

Developed recreation sites

Developed recreation sites provide much of the infrastructure necessary for the enjoyment of a wide variety of recreation activities in the analysis area. The Forest Service definition of developed recreation site is a recreation site on NFS lands that has a development scale of 3, 4, or 5. See glossary for the full definition that includes development scale delineation.

Table 2 identifies the number of recreation sites on the forest by categories of developed recreations sites. In addition to specific categories such as campgrounds or trailheads, the other developed recreation category includes day-use sites such as boat and fishing facilities and administrative sites such as cabin rentals.

Table 2. Forest Service developed recreation sites on the Forest

Site Type	Total Sites
Boating Site	19
Campground	22
Campground Group	1
Fishing Site	1
Interpretive Site	2
Lookout/Cabin	13
Observation Site	1
Picnic Site	5
Picnic Group Site	1
Ski Area Nordic	1
Snow Park (snowmobile)	2
Swimming Site	2
Trailhead	10
TOTAL	80

The Flathead National Forest also has two ski resorts under permit that are not owned by the Forest Service but provide a developed recreation opportunity primarily for alpine winter activities. Refer to the assessment for information on use numbers.

Because the grizzly bear conservation strategy (GBCS) is a document that applies to multiple agencies, the definition of a developed recreation site is different than the standard Forest Service definition.

The GBCS management direction in the Forest plan applies to overnight developed recreation sites, defined as follows:

> Overnight developed recreation sites are designed and managed for overnight use and have agency improvements made out of manmade materials that are intended to provide for public recreation and user comfort/convenience. They may have improvements needed to protect resources such as signs, road closures devices, bear resistant food storage devices and/or sanitation facilities. Examples on NFS include, but are not limited to: ski areas, campgrounds, sites with cabins, huts, lodges, recreation residences, visitor centers, and trailheads.

Throughout this document, the term "NCDE" will be added following the term "developed recreation site" when referring to the NCDE definition. If there is not a "NCDE" after developed recreation site, it refers to the Forest Service definition.

The Flathead National Forest also has two ski resorts under permit that are not owned by the Forest Service but provide a developed recreation opportunity primarily for Alpine winter activities. Refer to the assessment for information on use numbers.

Table 3 shows the number of developed recreation sites (NCDE definition) by category within the primary conservation area on the Forest. The largest category is trailheads that primarily provide day-use but sometimes have overnight facilities and are counted as overnight developed recreation sites (NCDE definition). The second largest category is day-use sites such as picnic areas, boating sites, and fishing sites. There are 63 campgrounds, 63 recreation residence and 20 overnight sites/buildings that are considered overnight facilities. Note that these are not all owned by the Forest Service but are under special use permit (e.g. recreation residence, lodges). Administrative sites are agency owned buildings such as bunkhouses, and work centers. Table 4 shows the capacity within the primary conservation area in overnight developed sites.

Table 3. Number of developed recreation sites (NCDE definition) by categories on the Forest in the primary conservation area

Area	Developed campgrounds	Day-use	Trailheads[a]	Administrative sites	Overnight sites/building	Residences
PCA	63	73	198	52	20	63

a. The NCDE definition of developed sites includes trailheads; the Forest Service definition of developed site does not generally include trailheads unless it is specifically designed for overnight camping or have associated improvements such as stock corral. Thus, the number of trailheads using the NCDE definition of developed sites is much larger (198) than trailheads using the Forest Service definition (10)

Table 4. Overnight developed sites (NCDE definition) capacity on the Forest in the primary conservation area

Site Type	Capacity[1]
Campground	552
Cabins	48
Residences	63
Rooms at Lodges	13
Bunkhouses	7

a. In the NCDE, measurement of capacity varies by site type. Campgrounds are by number of site in the campground; cabins and residences are by how many; lodge capacity is by number of rooms, and bunkhouses are by how many.

Dispersed Recreation

Dispersed recreation consists of those activities that take place *outside* of developed recreation areas. Over two-thirds of forest visitors come to the forest to engage in dispersed activities. Once on the forest, over 84 percent of visitors participate in dispersed recreation (NVUM 2010). Types of dispersed activities that occur on the forest include, but are not limited to, camping, hiking, fishing, skiing, hunting, gathering huckleberries, horseback riding, river use and snowmobiling.

Dispersed sites generally do not have fees associated with them and have little or no facilities such as toilets, tables or garbage collection.

In the winter, recreation staging (parking) becomes concentrated because many roads are closed by snow. Access to over-snow recreation depends on the major routes that are plowed throughout the season. Both motorized and non-motorized uses become concentrated in the front country areas. Once in the backcountry, winter use is often more dispersed since more acres are open to motorized use (increase from 3 to 34 percent of the forest in semi-primitive non-motorized and the use is not as limited to designated routes).

The forest indicates concentrated dispersed areas on the motor vehicle use map where visitors park in order to camp, fish, hunt, hike, and other activities.

Cross country motor vehicle travel is prohibited except when authorized in certain areas and on roads and trails open to motorized vehicles. These areas, roads and trails are shown on the Flathead National Forest motor vehicle use map for each district. The motor vehicle use maps also show where limited cross country travel is allowed solely to access a dispersed camping site.

Recreation use

National Visitor Use Monitoring

There is a national visitor monitoring program across the entire NFS where every 5 years, each forest monitors their use through exit surveys. The national visitor use monitoring program provides science-based estimates of the volume and characteristics of recreation visitation to the NFS. The Flathead National Forest last collected data in 2015; however the last year for which results are available is 2010. Table 5 shows visitation results by forest, the year it was sampled, recreation visits, wilderness visits, percentage of visitors living within 100 miles of the forest and percentage of visitors from Flathead County (NVUM 2010). As shown in table 5, the Flathead National Forest serves primarily a local area with the most visitation from within 100 miles away (75 percent of visitors), although about 13 percent of visitors travel over 500 miles to visit the forest. There is a sizeable group of frequent users of the Forest – nearly 28 percent of the visits are made by people

who visit more than 50 times a year. Out of the total visits to the forest, most visitors use areas of the Forest outside of designated wilderness.

Since survey protocols have evolved as each round of national surveys were conducted and individual units continued to refine their exit interview sites and associated information, it is not feasible to represent the information as trend data. These are simply snapshots in time and are not relative to one another.

Table 5. Recreation visits, wilderness visits and percentage of visitors living within 100 miles on the Forest

Year sampled	Recreation visits	Wilderness visits (% of total recreation visits)	Visitors living within 100 miles of forest (%)	Visitors from Flathead County (%)
2010	885,000	58,000 (7)	75	70
2005	852,000	20,000 (2)	73	75

Visitor use

Primary recreation activities

Figure 2 represents visitor's primary activity which is the reason the visitor came to the Flathead National Forest. Most forest visitors participate in several recreation activities during each visit in addition to their primary activity. For example, a visitor may come to the forest to camp at one of the campgrounds (primary activity) but they may participate in other activities such as swimming, relaxing and viewing scenery.

As shown in figure 2, the top four activities for forest visitors in 2010 were downhill skiing (29 percent), hunting (17 percent), hiking (12 percent) and viewing natural features (6 percent). Together these four activities account for almost 65 percent of total visitation. Hiking is something that over one-third of people participate. Viewing activities are even more popular, including viewing wildlife (36 percent) and viewing natural features (42 percent). Five years earlier, in 2005, the same four activities were the most popular: downhill skiing (20 percent), hunting (18 percent), hiking (11 percent), and viewing natural features (11 percent), which together accounted for over 60 percent of the visitation.

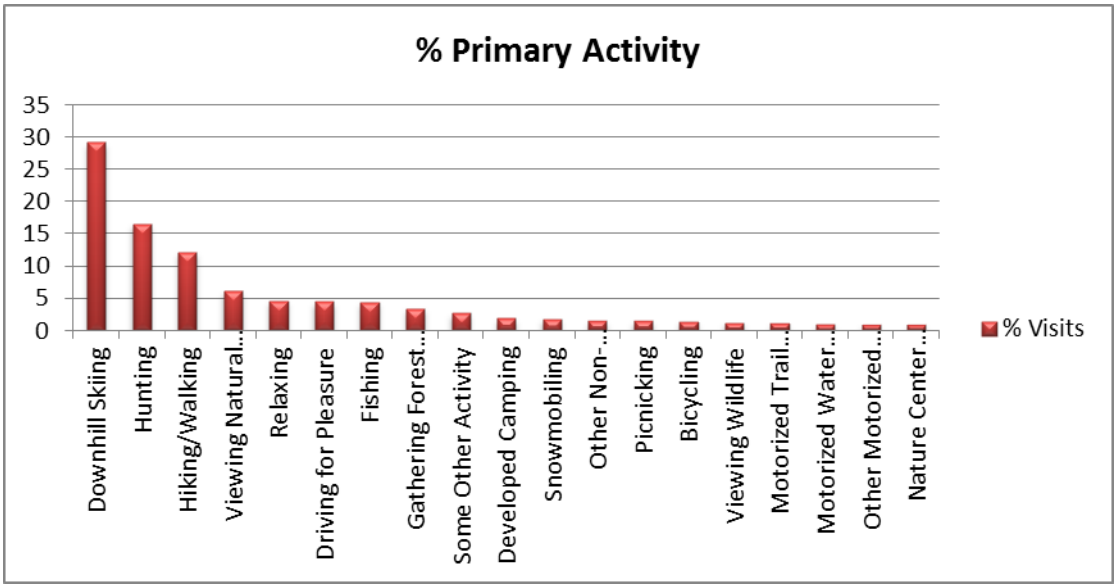


Figure 2. Percent visits by primary activity in 2010 on the Flathead

Participation rates by activity are shown in table 6. As an example, this table shows that 42 percent of visitors identified viewing natural features as a recreational activity in which they participated, but only 6 percent of visitors identified it as their main activity (figure 2) during their forest visit.

Table 6 compares the top activities reported in the 2005 and 2010 reports: viewing natural features went from second in participation to first, hiking and walking went from first in participation to fourth, and relaxing went from sixth in participation to third. Generally, the top 10 activities by percentage participation in 2005 were still within the top 10 activities in 2010.

Table 6. Top 10 activities by participation rate on the Forest 2010 and 2005

2010 Top 10 Activities	Participation (%)	2005 Top 10 activities	Participation (%)
1. Viewing Natural Features	42.2	1. Hiking / Walking	28.2
2. Viewing Wildlife	35.8	2. Viewing Natural Features	27.6
3. Relaxing	33.7	3. Viewing Wildlife	21.8
4. Hiking / Walking	33.5	4. Downhill Skiing	20.9
5. Downhill Skiing	30.1	5. Hunting	19.5
6. Driving for Pleasure	20.3	6. Relaxing	17.2
7. Hunting	18.0	7. Driving for Pleasure	16.2
8.Nature Center Activities	12.2	8. Fishing	11.8
9. Fishing	11.7	9. Nature Study	8.8
10. Gathering Forest Products	9.4	10. Gathering Forest Products	8.0

Source: NVUM 2005 and 2010

Access

Travel routes include NFS system roads and trails. Table 7 shows the miles of wheeled motorized access routes open for travel (year-around or seasonally) and are based on the motorized baseline density. Open motorized access routes are further distinguished by the miles within the primary conservation area, and the miles outside the primary conservation area.

Table 7. Miles of open roads and motorized trails, within the primary conservation area and zone 1

Area	Open Roads (mile)	Motorized Trails (mile)
Flathead National Forest	1,432	226
PCA within the Forest	824,	120
Zone 1, within DCA	223	16
Zone 1, no DCA	353	86

Please see *Infrastructure* section, "Forest System Roads" subsection, for detailed information on roads.

Trails

There are about 2,220 miles of system trails on the Flathead National Forest documented in the national infrastructure database, which is the official database for the Forest Service. There are about 1,107 miles of trails located outside of designated wilderness areas and about 1,115 miles within designated wilderness. In the last five years, the Flathead National Forest maintained about 1,000 miles of trails per year, and improved/reconstructed an average of 30 miles of trails.

Table 8 shows the total miles of trail by different types of allowable uses, by total miles and by type. Trails can have multiple types of allowable use on them, so many trails are duplicative in this table and cannot be totaled.

Table 8. Allowed summer trail use on the Flathead National Forest in miles

Bicycle	Hiking	Pack and Saddle	Wheeled Motorized
806	2,053	2,012	226

Motorized over-snow vehicles

Areas suitable for motorized over-snow vehicle use on the Flathead National Forest have been determined by the winter use provisions of the Flathead's Winter Motorized Recreation Plan Amendment 24 [USDA FS 2006]. This decision identified areas suitable and not suitable to motorized over-snow vehicle use (refer to Figure B-03 to B-05), including four late-season (outside of grizzly bear denning season) areas within the primary conservation area (Canyon Creek, Challenge-Skyland, Lost Johnny, and Six Mile areas as identified in amendment 24) where motorized over-snow vehicle use is allowable during April and May, refer to the Forest's current over-snow vehicle use map.

In addition to these late-season areas, there are route corridors in the North Fork GA with a 200 foot corridor (100 feet on either side of the road) that are designated open yearlong to over-snow vehicle use, conditions permitting. Because these are linear features, these routes care shown as *acres* and in *miles* in table 9. There are 347 miles of route corridors, encompassing about 8,433 acres. In the Hungry Horse GA, Swan Valley GA and Middle Fork GA, there are roads that are open yearlong to over-snow vehicles access, conditions permitting without the additional 100 feet corridor on either side of the road. These are shown in *miles* in table 9.

The Flathead National Forest and Montana Fish, Wildlife and Parks monitor motorized over-snow vehicle use, as well as known den locations and bears emerging from their dens, and report this information to the USFWS. The agencies have not detected any conflicts due to over-snow use on

the Flathead National Forest thus far. Motorized over-snow vehicle use is suitable on about 31 percent (751,376 acres) of the Flathead National Forest. Table 9 shows motorized over-snow vehicle use according to the three separate season (denning season for grizzly bears, late spring season, and year-long) across the Forest as well. These numbers reflect the Flathead National Forest Winter Motorized Recreation Plan Amendment 24 and any differences in acres and miles are due to GIS mapping realignments and updates to database and not because of changes in routes or areas on the ground.

Table 9. Miles and acres of over-snow routes and areas within the Forest by season allowed[1]

Season of Use Allowed	Motorized Over-Snow Vehicle Routes	Motorized Over-snow Vehicle Areas
Dec 1 to March 31	295 miles	457,133 acres (19 %)
April 1 to Nov 30[2]	623 miles	53,905 acres (2 %)
Year-long[3]	1046 miles	240,337 acres (10 %)

1. Numbers in this table reflect the Flathead National Forest Winter Motorized Recreation Plan Amendment 24; any differences in acres and miles are due to GIS mapping realignments and updates to database and are not because of changes in routes or areas on the ground.
2. Miles and acres are open for a portion of this time period, snow conditions permitting. In addition, they are open December 1 to March 31.
3. Year-long routes are open to motorized over-snow use conditions permitting.

3.9.5 Environmental consequences

Alternative A – no action

Recreation opportunity spectrum

The existing recreation opportunity spectrum was described above under the affected environment section. Refer to table 1 for the recreation opportunity spectrum class allocation.

Recreation

Recreation use is expected to increase in the analysis area. Capacity of developed campgrounds in many of the campgrounds is reached at peak times (July and August weekends). Use of dispersed recreation (recreation outside of developed sites) may increase as developed sites reach capacity. The existing 80 developed sites on the Flathead National Forest would be retained and there would not be limits on future development, other than those resulting from budget limitations. Dispersed recreation opportunities would continue to be available.

Focus recreation areas (MA 7 in the draft plan) were not a MA in the 1986 Forest Plan. A cross-walk of MAs from the 1986 Forest Plan has been developed for comparison with alternatives B, C and D, it generally included developed recreation sites, downhill ski resorts, and Nordic ski areas such as Round Meadow as MA 7. Approximately 5,655 acres were determined to fit this MA under alternative A.

Access

See the access section in the affected environment section for a description of alternative A existing conditions for motorized over-snow vehicle use.

The 1986 Forest Plan components under alternative A created management requirements that additional roads and trails would be closed and/or reclaimed. Approximately 518 miles of roads would need to be reclaimed, and either on the transportation system as impassable or off the

transportation system as decommissioned in order to fully meet Amendment 19 in each grizzly bear subunit, unless site-specifically amended. Additionally, 57 miles of trails would no longer allow wheeled motorized use (see table 10). This figure is an estimated programmatic assessment of the number of miles needed to meet Amendment 19 requirements. The actual number may be higher or lower depending upon changing access condition on adjacent lands and the site specific factors that must be considered when evaluating access and grizzly bear habitat needs. Amendment 19 does not apply to portions of the Salish GA west of Highway 93; therefore road and trail motorized use would not be reduced in that area.

Table 10. Grizzly Bear subunits and the estimated miles wheeled motorized trails estimated needed to close to meet 19-19-68.

Grizzly Bear Subunit Name	Estimated miles of wheeled motorized trails to close to meet 19-19-68
Peters Ridge	28 miles
Swan Lake	27 miles
Skyland Challenge	1 mile

This alternative would provide both motorized and non-motorized recreational opportunities as well as opportunities for mechanized transport (e.g., mountain bikes) and motorized over-snow vehicle use.

The Forest's trail system would increase by roughly 25 miles because trailheads would be relocated to where the road ends. This would be an increase in non-motorized trails.

Table 9 shows the motorized over-snow vehicle use would be suitable on 31 percent and mechanized transport on 52 percent of the land base.

Effects common to all action alternatives

Recreation use is expected to increase in the analysis area. With restrictions on new overnight development (NCDE definition) within the primary conservation area, the number and capacity of developed recreation sites (NCDE definition) on NFS lands that are designed and managed for overnight use by the public during the non-denning season shall be limited to one new developed recreation site per decade per bear management unit, or one increase in the overnight capacity at one site per decade per bear management unit above the baseline (see glossary), with listed exceptions. A change in the number or capacity of developed recreation sites may be offset by an equivalent reduction at another site(s) in the same bear management unit. Overnight developed recreation sites (NCDE definition) on the Flathead National Forest include campgrounds, cabins, recreation residences and lodges. Overnight developed recreation sites may reach capacity with limited ability to expand to meet increase demand within the primary conservation area. Outside of the primary conservation area, the limitation on overnight developed recreation sites is not applied. See table 11 for a summary of recreation capacity within the primary conservation area.

Table 11. Current capacity of developed recreation sites in the primary conservation area on the Flathead National Forest

Site Type	Capacity[1]
Campground	552
Cabins	48

Site Type	Capacity[1]
Residences	63
Lodges	13
Bunkhouses	7

1. In the Northern Continental Divide Ecosystem, measurement of capacity varies by site type. Campgrounds are by number of site in the campground; cabins and residences are by how many; and lodge capacity is by number of rooms

There are 12 bear management units within the primary conservation area on the Flathead National Forest. Out of these 12, six are shared with other forests or agencies (e.g. National Park Service). Depending on decisions of the other forests or agencies within the shared bear management units, the Flathead National Forest has the ability to increase 5 to 12 overnight developed recreation sites in the primary conservation area.

In addition, there are certain exemptions to the one increase in overnight developed recreation (NCDE definition) sites to one per bear management unit per decade that allow the forest to increase overnight developed recreation sites:

- allowing a change in the number or overnight capacity of developed recreation sites that is necessary to comply with Federal laws (e.g., Federal Rehabilitation Act);
- allowing a change in the number or overnight capacity of developed recreation sites that is necessary to address grizzly bear–human conflicts, resource damage, or human safety concerns;
- allowing an increase in the number of developed recreation sites due to the Forest Service acquiring lands with developed recreation sites.

In addition, if the forest proposes any further increase in the number or capacity of developed recreation sites that are designed and managed for overnight use in the bear management unit (i.e., more than one per decade), such an increase must be offset by reduction of an equal amount at another recreation site(s) in the same bear management unit, so that there is no net increase in overnight capacity in the bear management unit. This allows some flexibility to increase developed recreation sites that have reached capacity while decreasing sites that may be less used and not meeting capacity.

On the Flathead National Forest, there is one developed ski area (Whitefish Mountain Resort) in the grizzly bear primary conservation area and it does not have overnight capacity on NFS lands. There have been no known grizzly bear mortalities at the existing ski area. The Whitefish Mountain Resort special-use permit has mitigation measures in place to reduce grizzly bear-human conflicts and these would continue to apply under all alternatives.

There is no limitation to dispersed recreation sites which have minimal to no agency improvements that are made out of manmade materials. Disperse sites include, but are not limited to, outfitter camps or other primitive camping spots along a road, trail, water body, or at a road closure.

Some people may shift their uses to areas not occupied by grizzly bears or rely on uses where they have an increased sense of security such as using a hard-sided camper, developed campgrounds, day hiking on heavily used trails, or relying upon guided services. For other people, recreating in bear country would be an added attraction and an allure of wild country.

As recreation use increases and developed recreation sites are constrained, users may adapt as developed recreation sites reach capacity. Potential outcomes from restricting developed site capacity are:

- Change in use from developed recreation sites to dispersed recreation sites.
- Change in the time they use the areas to a different time of year such as spring or fall, when use is lower.
- Change their uses to other areas outside the primary conservation area on the Flathead National Forest, on the amendment forests or off-forest where use is lower.
- Use of the national reservation system at campgrounds that have reached capacity to assist users to be successful in camping at specific campgrounds that have reached capacity.
- Private enterprise may create new developed sites on private land to accommodate increasing use.

Alternatives B, C and D effects

Recreation opportunity spectrum

The desired recreation opportunity spectrum varies, by alternative, in part, based on changes in MA allocation. There is a direct effect to acres by recreation opportunity spectrum class by changes in MA by alternative. Management areas which changed the allocation of recreation opportunity spectrum classes by alternative are primarily 1b and 5a, 5b, 5c, and 5d as well as 7.

Visitor use is expected to continue to increase, regardless of alternative selected. Management actions can be taken to reach the desired recreation opportunity spectrum settings as described in the summer and winter recreation sections of chapter 2 of the draft forest plan and shown in figures B-19 to B-24 desired ROS maps for all alternatives, both summer and winter.

The desired recreation opportunity spectrum can be used to show the general effect of alternatives to recreation settings and opportunities across the forest.

Table 12 displays the allocation of the summer recreation opportunity spectrum and table 13 the winter recreation opportunity spectrum for each alternative (refer to figures B-19 to B-24). In winter compared to summer, there is a shift from roaded natural to semi-primitive motorized which normally occurs because most Forest Service roads are not plowed. There is also a decrease of semi-primitive non-motorized because there are areas open to motorized over-snow vehicles across the forest, creating a semi-primitive motorized setting.

In the summer and winter, the non-motorized recreation opportunity spectrum classes (primitive and semi-primitive non-motorized) are the highest under alternative C. This is because of an increase in recommended wilderness and a decrease in MAs 5b and 5c as compared to the other alternatives. Alternative D has the least amount of acres in the non-motorized recreation opportunity classes because of reduced acres allocated to recommended wilderness and an increase in allocation to MA 5b and 5c. The summer and winter total non-motorized recreation opportunity classes remain very similar under alternative B as compared to alternative A, with a slight decrease under alternative B in the summer and a slight increase in the winter.

Conversely, the summer and winter motorized recreation opportunity classes (semi-primitive motorized and roaded natural) are higher under alternative D and lower under alternative C as compared to alternative A. Alternative D provides the most motorized recreation opportunity setting while alternative C presents the least. The summer and winter total motorized recreation opportunity spectrum settings remain similar under alternative B as compared to alternative A, with a slight increase under alternative B in the summer and a slight decrease in the winter.

Table 12. Desired summer recreation opportunity spectrum classes on the Forest by alternative

Alternative	Primitive (%)	Semi-primitive non-motorized (%)	Semi-primitive motorized (%)	Roaded Natural (%)	Rural (%)
A	48	24	3	25	<1
B	53	17	3	28	<1
C	66	9	1	24	<1 t
D	45	13	8	34	<1

Table 13. Desired winter recreation opportunity spectrum classes on the Flathead National Forest by alternative

Alternative	Primitive (%)	Semi-primitive non-motorized (%)	Semi-primitive motorized (%)	Roaded Natural (%)	Rural (%)
A	48	14	34	4	<1
B	53	11	31	4	<1
C	66	5	25	4	<1
D	45	16	34	5	<1

Developed recreation sites

See effects common to alternatives B, C and D

Focused recreation areas (management area 7)

Focused recreation areas typically have certain types of recreation uses featured such as a large lake or reservoir, developed ski area or year-round resort, large campgrounds, or trail systems for featured recreational activities. Additional motorized and non-motorized recreation opportunities not specifically designated as focused recreation MA are also broadly available across the Flathead National Forest, such as hiking, horseback riding, mountain biking, and motorized over-snow vehicle uses.

Table 14 lists the focused recreation areas for each alternative along with a brief description of featured activities and acres. Alternative B has 15 areas in the Focused Recreation MA covering about 32,755 acres (1 percent of the forest). Alternative C has 14 areas totaling about 31,200 acres, while alternative D has 20 areas totaling 61,060 acres (2 percent of the forest). Alternative C has the least and alternative D the most number of sites and acreage in focused recreation MAs.

Table 14. Focused recreation areas (management area 7) by alternative

Focused Recreation Area	Featured Activities	Alt B acres	Alt C acres	Alt D acres
Ashley Lake (2 sites: north side 93 acres, south side 10 acres)	Developed recreation including camping, fishing, and boating	103	103	103
Big Creek Campground and Work Station	Developed recreation including camping, boating, fishing and hiking; youth conservation education.	57	57	57
Big Mountain (includes Whitefish Mtn Resort)	Downhill skiing, cross-country skiing, hiking, mountain biking, conservation education	4,111	4,111	4,111
Blacktail Mountain Ski Area	Downhill skiing, hiking, mountain biking,	891	891	891
Blacktail Wild Bill Trail System	Motorized trail riding opportunities	4,966	4,966	4,966
Blacktail-Foys (alternative D only)	Hiking, mountain biking, horseback use close to communities. Includes Lakeside to Blacktail, and Foy's to Blacktail trails.	N/A	N/A	1,047
Camp Misery Trailhead (alternative D only)	Access to Jewel Basin Hiking Area	N/A	N/A	330
Cedar Flats Off-Highway Vehicle Area	Motorized trail riding opportunities	2,008	2,008	2,008
Crane Mountain	Mountain biking and dispersed recreation	1,023	1,023	1,023
Crystal-Cedar Area (alternative D only)	Dispersed recreation, hiking, mountain biking, horseback use close to communities.	NA	NA	13,396
Holland Lake Campground	Developed recreation including camping, boating, fishing and hiking	593	593	593
Hungry Horse Off-highway Vehicle Area	Motorized trail riding opportunities	71	71	71
Hungry Horse Reservoir	Developed and dispersed recreation including camping, boating, fishing, hiking.	13,113	13,113	13,113
Ingalls Mountain (alternative D only)	Single-track wheeled motorized use on existing open roads. New connector routes may be create to provide a high elevation loop wheeled motorized trail.	N/A	N/A	2,431
Krause Basin (alternatives B and D only)	Non-motorized trails and limited motorized trails on designated and signed routes	1,578	N/A	1,578
Lion Lake	Day use picnic site, hiking, fishing and, swimming	99	99	99
Nordic groomed ski areas	Groomed cross country ski areas: Round Meadows, Essex, and Blacktail Mountain	3,906	3,906	3,906
Swan Lake Campground and day use area	Developed recreation including camping, boating, fishing and hiking	95	95	95
Tally Lake Campground	Developed recreation including camping, boating, fishing and hiking	159	159	159
Tally Mountain (alternative D only)	Mountain bike loop trail opportunities	N/A	N/A	4,692
Werner-Nicola (alternative D only)	Dispersed recreation, hiking, mountain biking, horseback use close to communities.	NA	NA	6,392

Access

Suitability for motorized recreation

Suitability for motorized use is by MA for each alternative and by the desired recreation opportunity spectrum as mapped for each alternative. See figures B-19 to B-24 for the recreation opportunity spectrum map for each alternative, summer and winter. The MA suitability for motorized over-snow vehicle use vary by alternatives, see figures B-03 through B-05. Travel management decisions are separate, project-level decisions that determine the specific areas and routes for motorized recreation consistent with the desired recreation opportunity spectrum as mapped. Just because an area is suitable for motorized use, does not mean motorized use is allowable everywhere in that setting. Motorized use (wheeled and/or over-snow vehicle) is restricted to designated trails, roads and areas as shown on the motor vehicle use maps for the Flathead National Forest.

For all alternatives, designated wilderness (MA 1a) is not suitable for motorized use or mechanized transport (MA1a-SUIT 01).

The suitability of recommended wilderness (MA 1b) varies by alternative. In alternative B, these areas are suitable for *existing* motorized over-snow vehicle use (occurring on approximately 973 acres); thus, 186,768 acres are not suitable for motorized over-snow vehicle use under this alternative. In this alternative, existing mechanized transport (e.g. bicycles) are suitable. In alternative C, this MA is not suitable for motorized over-snow vehicle use, wheeled motorized use or mechanized transport. In alternative D, there are no acres allocated to recommended wilderness.

Management area 2a is designated wild and scenic rivers and MA 2b is eligible wild and scenic rivers. Motorized suitability in these MA varies by type of classification (wild, scenic or recreational) for the designated or eligible rivers or segment. Wild classification is not suitable for motorized use while scenic and recreational rivers are suitable for motorized use. Most rivers with a wild classifications are within designated wilderness except for Lebeau Creek. This suitability is the same for all alternatives.

Management area 3a (administrative areas) is suitable for motorized use. Suitability for MA 3b (special areas) varies by special area. Suitability for these MAs are the same for all action alternatives, although alternative D has additional areas allocated to MA 3b.

Management areas 4a (research natural areas) and 4 b (experimental forests) are suitable for motorized use on designated trails. This suitability is the same for all action alternatives.

Backcountry MA 5a is not suitable for motorized travel. Backcountry MA 5b is suitable for motorized travel only on designated roads and not suitable for motorized over-snow vehicle use. Backcountry MA 5c is not suitable for wheeled motorized but suitable for motorized denoted by the motorized over snow-vehicle use, refer to the motorized over-snow suitability maps, figures B-03 to B-05. Backcountry MA 5d is suitable for summer wheeled motorized travel on designated roads, trails and areas. General forest MAs 6a, 6b and 6c are suitable for wheeled motorized and motorized over-snow vehicle travel on designated routes and areas that is denoted on the over-snow vehicle map, refer to figures B-03 to B-05. Management area 7 which is the focused recreation areas, vary by area. Although the suitability call for these MAs remain consistent for all alternatives, the allocation of these MAs differ by alternative, resulting in a change in suitability for each alternative. Table 15 summarizes the suitability for motorized vehicle use by MA.

Table 15. Summary of suitability of wheeled motorized or motorized over-snow vehicle use by MAs

Suitability	Management areas
Not suitable for wheeled motorized or motorized over-snow vehicle travel	1a, 1b (alternative C only), 2a and 2b rivers classified as wild, 5a
Suitable for existing motorized over-snow vehicle use	1b in alternative B only
Not suitable for wheeled motorized travel	5c
Suitable for wheeled motorized travel on designated routes or areas	5b, 5d
Suitable for wheeled motorized and motorized over-snow vehicle travel on designated routes and areas that is denoted on the over-snow vehicle map	2a and 2b rivers classified as scenic or recreational, 3a, 4a, 6a, 6b, 6c
Suitable for motorized over-snow vehicle travel on designated routes and areas that is denoted on the motorized over-snow suitability map	5c
Varies	3b, 7

Trails

Please see *Infrastructure* section, "Forest System Roads" subsection, for detailed information on roads.

Currently, there are about 2,220 miles of system trails on the Forest; 1,107 miles (50 percent) of trails are located outside of designated wilderness areas and 1,115 miles (50 percent) are within designated wilderness. Outside of designated wilderness, there are 226 miles (10 percent) of wheeled motorized trails on the Forest. Ninety-one percent of the forest trail system allows pack and saddle use, with 92 percent of trails allowed for hiking (some trails are groomed snowmobile trails these are not considered hiking trails). Conflict between motorized and non-motorized uses may sometimes occur. But with 10 percent of the forest trails open to wheeled motorized use (which also allows non-motorized use), there is a low amount of trails on the Forest where both types of uses can legally use. In addition, not only are there many trails for non-motorized users to legally use (compared to motorized users to legally use), the motorized trails are clearly marked as such on the district motorized use map and usually a physically sign on the trail or trailhead, offering the non-motorized users the choice on whether to share that trail with wheeled motorized users.

In alternative C, existing wheeled motorized use and mechanized transport is not suitable in recommended wilderness area, reducing the amount of motorized opportunity for wheeled motor vehicle by 75 miles on the Forest. About 417 miles of mechanized transport may be closed with this alternative after a site-specific analysis. In addition, about 48 miles of closed roads (maintenance level 1) that are currently within the recommended wilderness areas may need to be to be removed from the system after site-specific analysis.

Under alternative C, trails open to public motorized use in the Salish demographic connectivity areas portion of the Salish Mountain GA would not exceed baseline levels, but some additional motorized trail access could occur in zone 1 outside of the Salish connectivity areas. This may result in an overall reduction in opportunities for motorized trails under this alternative.

Under alternatives B and D, there would be no change to wheeled motor vehicle use.

Motorized over-snow vehicle use

For suitability of winter motorized over-snow vehicle use for each alternative, refer to figures B-03 to B-05. These maps show where motorized over-snow vehicle use is suitable and not suitable on

the forest. Where it is not suitable, motorized over-snow vehicle use is not suitable all year long. Where it shows motorized over-snow vehicle use is suitable, a portion of the areas change with different seasons: grizzly bear denning season (December 1 to March 31), outside of grizzly bear denning season (April 1 to Nov 30), routes/roads open to over-snow vehicle to May 14 (conditions permitting), and roads open yearlong (conditions permitting). Table 15 shows the acres suitable for motorized over-snow use in areas by alternative. Table 16 displays the miles suitable for motorized over-snow use on routes by alternative. Some suitable areas have routes going through them, while other areas do not. Any feature that is a polygon is listed in table 15 as acres. Any linear routes are listed in table 16 as miles.

Currently, motorized over-snow vehicle use is suitable on about 31 percent of the Forest and not suitable on 69 percent of the Forest. The actual use of the 31percent of the Forest suitable for motorized over-snow use is less as terrain and vegetation also influence where motorized over-snow vehicles can physically go. Vegetation conditions are dynamic over time and change in response to disturbance and succession. Whereas fire may open up dense forest for over-snow use, succession is closing areas to over-snow use in areas suitable for over-snow use. Non-motorized and non-mechanized winter use such as Nordic skiing, backcountry skiing and snow shoeing are allowable on 100 percent of the Forest. Mechanized transport such as fat-tire bikes that ride over snow are not allowed in designated wilderness and specific areas on the forest that have closure orders prohibiting mechanized transport.

As shown in tables 15 and 16, alternative D has the most overall acres and miles suitable for over-snow vehicle use (approximately 32 percent of the forest), while alternative C has the least (25 percent of the forest). This change in suitability between alternatives is because of changes in MA allocation and a change in desired conditions for over-snow vehicle use in the draft forest plan.

There are four late-season areas (outside of grizzly bear denning season) within the primary conservation area (Canyon Creek, Challenge-Skyland, Lost Johnny, and Six Mile as identified in amendment 24) where motorized over-snow vehicle use is suitable April 1 to Nov 30 (see tables 15 and 16). This category also includes routes on the Forest, primarily in the Salish GA, that allow motorized over-snow vehicle use until May 14. For late-season use, there is a slight increase in acres suitable under alternative D and a slight decrease under alternative B from current. Under alternative C, no acres are suitable for late-season use.

In addition, there are routes and areas that are open year-long (conditions permitting) to motorized over-snow vehicle use (see tables 15 and 16). There are route corridors in the North Fork GA with a 200 foot corridor (100 feet on either side of the road). There are also roads that are open yearlong (conditions permitting) to motorized over-snow vehicle use in the Hungry Horse, Swan Valley and Middle Fork GAs that do not have the 200 foot corridor. Alternative D has the most miles and acres suitable to late-season motorized over-snow use. Alternative C has no miles or acres suitable for late-season motorized over-snow use.

Table 16. Acres and forest wide percent of motorized over-snow areas and corridors within the Forest by season allowed by alternative

Alternative	Dec 1 to March 31	April 1 to Nov 30[1]	Year-long[2]
A	457,133 acres (19 %)	53,905 acres (2 %)	240,337 acres (10 %)
B	450,553 acres (19 %)	54,328 acres (2 %)	240,337 acres (10 %)

Alternative	Dec 1 to March 31	April 1 to Nov 30[1]	Year-long[2]
C	349,618 acres (15 %)	862 acres[3] (0 %)	240,085 acres (10 %)
D	475,076 acres (20 %)	55,556 acres[4] (2 %)	240,337 acres (10 %)

1 Miles are open for a portion of this time period, snow conditions permitting. In addition, they are open Dec. 1 – March 31.
2 Year-long route are open to motorized over-snow use conditions permitting.
3 The 862 acres are from the Canyon Creek area where the route is a corridor, 100 feet either side of the route.
4 Alt. D has 1,228 more acres in the Skyland-Challenge late season area than Alt. B.

Table 16. Miles of motorized over-snow routes within the Forest by season allowed by Alternative

Alternative	Dec 1 to March 31	April 1 to Nov 30[1]	Year-long[2]
A	295 miles	623 miles	1046 miles
B	295 miles	623 miles	1046 miles
C	292 miles	623 miles	1044 miles
D	295 miles	623 miles	1046 miles

1 Miles are open for a portion of this time period, snow conditions permitting. In addition, they are open Dec. 1 – March 31.
2 Year-long route are open to motorized over-snow use conditions permitting.

Consequences to sustainable recreation and access from forest plan components associated with other resource programs

Effects from vegetation management

Commercial timber harvest activities will generally result in road reconstruction and continued application of best management practices on existing NFS roads. New road construction is likely to be limited and temporary road construction used as a more common method for short-term access needs.

Administrative use of gated roads that normally prohibit motor vehicle use yearlong is likely when management activities such as pre-commercial thinning, invasive weed treatments, or other non-commercial silvicultural treatments are planned.

Because general forest (management area 6) MA allocations are lowest in alternative C, it would generally be expected to result in the least amount of vegetation management activities and result in a lower amount of road use compared (respectively) to alternatives A, B, and D. Consequently, reduced traffic (i.e., number of vehicles on roads), both commercial and administrative, can be expected. Associated with reduced commercial use is the reduction of road reconstruction and best management practices work. Road maintenance activities done in conjunction with commercial use would also occur less often since this work is only required commensurate with use.

Timber harvest has the potential to affect recreation experiences and opportunities in several ways. Short-term effects may include increased noise and dust levels; the sight of landscapes altered by differing types of harvesting; the presence of slash piles, and roads re-constructed or constructed for timber sales; conflicts with logging trucks on roads used by other drivers or by bicyclists; and the removal of snow for winter log hauling from roads frequented by winter recreational users. Users may be temporarily displaced to other locations because of log truck traffic, helicopter operations, and the noise from chainsaws.

Alternative A has the highest number of acres in MA 6a-c where most of the timber harvest and other vegetation management activities will take place, followed by alternatives B, D, and C.

Road development for timber management purposes in undeveloped areas has the potential to attract more visitors to the interior of the Forest where access previously has been limited. As use increases, visitors would experience less solitude and remoteness. Primitive and semi-primitive non-motorized settings could change to semi-primitive motorized and roaded natural settings. Recreational benefits from vegetation management can include new roads and trails and the opportunity to gather firewood. In many cases, roads built for logging operations are then used by recreationists, although these roads typically are closed and/or decommissioned after completion of the timber harvest activity. Depending on resource objectives, some logging roads can be left open to create additional dispersed recreation opportunities.

Effects from wildlife management

All alternatives have management direction that would continue to support a recovered grizzly bear population. Alternatives differ in the range of future actions that could occur. Alternative A could reclaim (either on the transportation system as impassable or off the transportation system as decommissioned) an additional 518 miles of motorized roads. Additionally, 57 miles of motorized trails could be closed to motorized use. Alternatives B, C and D would continue the baseline system roads and wheeled motorized trails.

Forest plan wildlife management direction (e.g., GA-SM-GDL 01) can directly affect motorized recreation opportunities. Restrictions that limit types of access and seasonal closures during sensitive periods, such as mating, calving, and when animals emerge from dens, can temporarily displace recreationists to other areas. The forest's MVUM limits motor vehicle use to designated routes or areas, yearlong or seasonally, often in response to wildlife needs.

Recreational benefits from wildlife management could include increased hunter and wildlife viewer satisfaction, as well as maintaining angler satisfaction. The effect on recreation from wildlife management is the same for all alternatives.Effects from fire and fuels management

Fuels management activities (e.g., prescribed burning) are likely to continue. Fuels management effects on recreation are similar to the effects described under vegetation management. An increase in fire extent, creating a long-lasting change to the setting, could cause a shift in recreation use. The degree of these effects is difficult to determine and based on the size and intensity of a wildfire event. Prescribed fire has some level of predictability for time, location, and intensity, which may decrease the short-term impacts on visitors. These effects are common to all alternatives.

Fire suppression actions are also likely to continue and could result in the use of gated roads as described above. In some cases, roads that are impassible to motor vehicle use (due to re-vegetation or other restrictive condition) may be opened in order to facilitate suppression actions. These roads would probably be used for the duration of the suppression efforts and post-fire work and then returned to their previous status.

Effects from minerals management

Proposals for exploration and development are driven by external parties and market forces and regulated by existing mining law. Access and road development (long-term or temporary) is often associated with mineral exploration and development, but a site-specific analysis is required prior to any approval for exploration or development activities.

If any mine reclamation activities occur they would likely use existing roads. These may be roads that are not currently designated for motor vehicle use. They would probably be used for the duration of the reclamation work and then returned to their previous status.

Recreation could be affected by mineral exploration and extraction in all alternatives. Short-term effects may include noise and visual impacts from open-pit or underground mining operations. In the long-term, effects may include: development from a more naturally appearing landscape; new permanent underground or open pit mines and physical structures; and new roads and road corridors constructed for mining or drilling operations that may change the recreation setting.

The potential for oil and gas development on the Flathead National Forest is varies from low to high across the forest. Portions of the Forest having a high potential for development are lands east of the Great Bear Wilderness, land and surrounding the western boundary of the Great Bear Wilderness from the town of West Glacier, Montana to Horse Ridge near Spotted Bear Ranger Station. The rest of the forest is moderate and low for potential oil and gas leasing. Mineral facilities could affect visitors depending on the location of development and the setting affected.

Cumulative effects

The analysis area for cumulative effects includes the Flathead National Forest and adjacent public lands including the Kootenai, Lolo, Lewis and Clark and Helena National Forests, Glacier National Park, Montana State lands, and Flathead and Missoula County and local parks. These public lands provide a wide range of recreation opportunities in addition to the Flathead National Forest. However, differences in agency missions often result in different types of recreation experiences. National Park Service tends to more tightly manage visitor activities. They provide highly developed and managed visitor facilities, as well as offer permitted back-country opportunities. The other national forests provide opportunities similar to the Flathead National Forest. Montana State Parks typically emphasize particular land features such as a lake, and offer related recreation opportunities such as boating, fishing, swimming, and camping. Local and county park facilities are typically oriented toward day users (some offer camping) and more urban recreation opportunities such as soccer fields, picnic shelters, and playgrounds. The Flathead National Forest management emphasizes dispersed recreation over developed recreation although there are developed recreation sites such as campgrounds. The Forest provides opportunities for a wide variety of recreational activities from primitive backcountry backpacking to downhill skiing. Adjacent national forests receive similar recreation visitation than the Flathead National Forest, but overall recreation visitation is higher in and around the Flathead National Forest due to the adjacency of the Glacier National Park. In order to address the impacts associated with increased visitations, all public land agencies have employed additional recreation management actions or have installed additional facilities to prevent damage to natural and cultural resources.

Within the planning period (the next 10 to 15 years), human population growth—as well as growth and demand for a variety of recreation settings, experiences, and opportunities—is expected to increase. Flathead County population has been growing at a far greater rate than the state and national averages, which is likely to continue throughout the life of this plan. A growing population places increasing demands on recreation that could result in more human concentration and use at existing recreation areas, increased conflicts, increased number of watercraft and off-highway vehicles, and may reduce the quality of recreation settings. The increasing use of off-highway vehicles may result in increased conflict among motorized and non-motorized user groups throughout the cumulative effects analysis area. As use increases, compliance with regulations could become a greater challenge as recreational participants increase and often compete for space and resources. This is likely to result in the greatest impact on the areas close to communities that

offer semi-primitive and primitive recreation settings which emphasize solitude, challenge, risk, unmodified natural environments, and minimal encounters and/or signs of other users.

As populations in Montana and especially Flathead county increases, the demand for recreational opportunities and open space will likely grow. Land management agencies will continue to provide a variety of recreation opportunities, but are not likely to be able to meet all the demand for every activity desired. All alternatives accommodate a mix of recreation opportunities and settings for recreationists. Alternative C provides the most amount of non-motorized settings for both summer and winter, the most amount of primitive settings, and lower amount of focused recreation settings than alternatives B and D. Alternative D provides the most amount of motorized settings for both summer and winter, provides the most amount of roaded setting and increases the amount of focused recreation MAs on the Forest more than alternatives B and C.

3.10 Scenery

3.10.1 Legal and administrative framework

Law and executive orders

Federal law

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended): This act authorizes the establishment of national forests.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L.86-517, 74 Stat.215): This act provides direction to the NFS lands to provide access and recreation opportunities. The act states, “The policy of Congress is that national forests are established and administered for outdoor recreation…”

3.10.2 Key indicators

- Acres/percentage of scenic integrity objectives by alternative.

3.10.3 Methodology and analysis process

The forest completed an inventory of landscape visibility, scenic attractiveness, and compiled scenic classes. In 2011, the Forest Service’s Northern Region completed existing scenic integrity mapping at a regional scale.

The scenery management system is a systematic approach to inventory, analyze, and monitor the scenic resources. This system recognizes natural disturbance processes such as fire, insects, and disease, to be part of the natural landscape that is dynamic and also important in maintaining healthy, sustainable, and scenic landscapes. The scenery management system is used in the context of ecosystem management to determine the relative value, stability, resiliency and importance of scenery; assist in establishing overall resource objectives, and ensure high-quality scenery for future generations.

Major components are:

- Scenic character descriptions
- Scenic attractiveness

- Landscape visibility (concern levels, distance zones, and viewsheds)
- Existing scenic integrity
- Scenic classes.

The 1987 Forest Plan used a system called the visual management system which was a systematic approach to inventory, analyze and monitor scenic resources but it did not recognize or incorporate natural disturbance processes such as fire, insect and disease. The no-action alternative utilizes this system; a cross-walk between the visual management system terminology of visual quality objectives compared to the scenery management system terminology of scenic integrity objectives is shown in table 17.

Table 17. Cross-walk between visual quality objective and scenery management system terms

Visual Quality Objective terminology	Scenery Management System terminology
Preservation	Very High
Retention	High
Partial retention	Moderate
Modification	Low
Maximum modification	Very Low

Information sources

Information used to conduct the analysis generally comes from spatial information contained in the geographic information system data.

Analysis area

The geographical scale used for the analysis was the forest-wide scale, which includes the encompassing viewsheds of Flathead National Forest lands and non-forest lands.

3.10.4 Affected environment (existing condition)

Flathead National Forest Scenic Character Description

Scenic character is defined as the combination of the physical, biological, and cultural images that gives an area its scenic identity and contributes to its sense of place. Scenic character provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity.

Located in the heart of the northern Rocky Mountains and amidst the mountains and valleys of western Montana, the Flathead National Forest is part of a large and intact ecosystem that includes: Glacier National Park, multiple national forests (Kootenai, Lewis and Clark, Lolo) and other state, federal and tribal lands. The Flathead National Forest is part of the Northern Continental Divide Ecosystem as well part of the Crown of the Continent.

Incredible natural features serve to delineate the forest's boundaries. The North and Middle Forks of the Flathead River and the Continental divide delineate much of its eastern boundary, while to the west, the forest is bounded by the Mission Mountains Range, Flathead Lake, the Salish Mountains, and the Whitefish Range. The Flathead National Forest abuts Canada to the north, and the Swan Mountain Range and valley to the south.

Landforms vary greatly, from the magnificent and craggy, rocky, peaks of the Mission Range to the more rounded, glacial landforms of the Swan valley and Salish Mountains. Diversity in geology, elevation, and climate, and annual precipitation result in a wide variety of plant life, from lush groves of cedars cloaked in moss to whitebark pine clinging to the tops of windswept mountain ridges. Dense forests occupy almost 90 percent of the forest's landscapes and include Englemann spruce, subalpine fir, lodgepole pine, Douglas fir, and western larch. Green pockets of maple, willow, and birch are scattered across the northern edge of the Bob Marshall Wilderness while traces of grand fir, western white pine, ponderosa pine and aspen occur across the forest. The outstanding multi-colored displays of wildflowers in the alpine meadows and high basins are evident in late summer. Dominant scenery attributes include open, park-like conifer and mixed conifer forest settings dominated by large trees with diverse forest canopy and mosaic vegetative patterns including vivid fall stands of cottonwoods and aspen groves.

Elevations generally range from 3,000 to 9,500 feet. The tree line is generally up to 8,000 feet, giving way to alpine vegetation. Water is abundant including rivers, streams, lakes, reservoirs, glacial potholes, fens, and bogs. Mean annual precipitation ranges from 20 to 60 inches. Streams flow into the Swan, Stillwater, and thee three forks of the world renowned Flathead River headwaters. These drainages are moderately to deeply incised. They eventually flow into Flathead Lake, the largest freshwater lake west of the great lakes. Many other lakes occur in glaciated terrain and at higher elevations. The abundance of water in this landscape adds to the richness of the scenery. Several large and small crystal clear lake and lush wetland areas are scattered throughout the forest creating thick pockets of vegetation and picturesque landscape. These distinctive Flathead National Forest landscapes include a variety of landforms, water features and vegetation are highly scenic. Research shows that people prefer more visually complex scenes, as opposed to more monotonous ones (Ryan 2005).

Cultural features are evident across the forest and include log cabins and remnants of early Euro-American settlements, Forest Service ranger stations and fire lookouts, and Native American travel routes and cultural sites. Many of the structures, trails and sites have retained their historic integrity and add to the area's character and sense of place.

Flathead National Forest Scenic Attractiveness

Scenic attractiveness is the primary indicator of the intrinsic beauty of a landscape. It helps determine the level of importance of scenic beauty based on perceptions of landform, vegetation patterns, compositions, water, and land use patterns and cultural features. Landscape elements are rated at various levels of scenic values or attractiveness and the forest scenic character descriptions serve as the frame of reference for determining scenic attractiveness.

Scenic attractiveness classifications were determined for the Forest using information describing the landform, elevation, slope, vegetation and percentage rock outcrop from soil survey of Flathead National Forest area, Montana (USDA Forest Service and Natural Resources Conservation Service, September 1998).

Table 18 shows the area of the Flathead National Forest within each scenic attractiveness classification. The majority of the Forest lands are distinctive relative to the surrounding landscape. Higher levels of scenic attractiveness occur in landscapes with a greater degree of naturalness, diversity of features, and uniqueness.

Table 18. Acres and percent of forest within each scenic attractiveness rating on the Forest

Scenic Attractiveness	Areas (acres)	Areas (percent)
A – Distinctive: Areas of unusual, unique or outstanding scenic quality	1,751,382	73
B – Typical: Areas that provide ordinary or common scenic quality	474,275	20
C – Indistinctive: Areas of low scenic quality	165,141	7

Existing Scenic Integrity

Scenic integrity measures the degree to which a landscape is free from visible disturbances that detract from the natural or socially valued appearance, including any visible disturbances due to human activities or extreme natural events outside of the natural range of variation. Scenic integrity measures these disturbance effects in degrees of consistency, harmony, dominance and contrast with the valued scenic character. Scenic integrity uses a graduated scale of five levels. These levels and photo examples of each are shown in table 19 and table 20 shows these areas in total acreages.

Table 19. Scenic integrity levels and pictorial examples

Scenic Integrity Level	Example
Very High Integrity – the valued scenery appears natural or unaltered. Only minute visual disturbances to the valued scenery, if any, are present.	
High Integrity – the valued scenery appears natural or unaltered, yet visual disturbances are present; however, they remain unnoticed because they repeat the form, line, color, texture, pattern and scale of the valued scenery	
Moderate Integrity – the valued scenery appears slightly altered. Noticeable disturbances are minor and visually subordinate to the valued scenery because they repeat its form, line, color, texture, pattern and scale.	
Low Integrity – the valued scenery appears moderately altered. Visual disturbances are co-dominant with the valued scenery, and may create a focal point of moderate contrast. Disturbances may reflect, introduce or “borrow” valued scenery attributes from outside the landscape being viewed.	

Scenic Integrity Level	Example
Very Low Integrity – the valued scenery appears heavily altered. Disturbances dominate the valued scenery being viewed; and they may only slightly borrow from, or reflect, valued scenery attributes within or beyond the viewed landscape.	

Table 20. Existing scenic integrity of the Forest

Scenic Integrity	Area of Forest (%)
Very High	48
High	37
Moderate	4
Low	11

The Flathead National Forest has a wide range of existing scenic integrity (see figure 1-50). Areas designated for very high scenic integrity are often remote and pristine like the Bob Marshall Wilderness and other designated wilderness and recommended wilderness areas. The majority of non-wilderness lands that, for the most part, are natural appearing are rated high, which includes the majority of forest lands showing little human-made modifications. Forest lands that have been heavily harvested or that have heavily-modified landscapes because of roads or other human-made visually intrusive infrastructure are rated low. For example, portions of the Tally Lake Ranger District and portions on the Swan Lake Ranger District near Lakeside, Montana show past vegetation harvest units in geometric shapes and contrasting road cut and fill elements that would classify as low scenic integrity.

Scenic Classes

Scenic classes represent the relative landscape value by combining visibility mapping inventories and scenic attractiveness inventories. Generally scenic classes 1 and 2 have high public value, classes 3, 4 and 5 have moderate value, and classes 6 and 7 have low value. Scenic classes also identify the relative priority for public scenery concerns during the forest plan alternative formulation process.

Scenic Integrity Objectives

Scenic integrity objectives are developed in coordination with the recreational setting, management direction, and the scenic class that were developed from the scenic inventory.

3.10.5 Environmental consequences

The scenic resource is affected by management activities that may alter the appearance of the landscape. Short-term effects to scenery are usually considered in terms of degree of deviation to desired conditions. The scenic character can be changed over the long term or cumulatively by the alteration of the landscape. Management activities that have the greatest potential of affecting scenery include the following:

- Vegetation management and road construction/reconstruction

- Special use utility rights-of-ways
- Mineral extraction
- Fire suppression.

Alternative A – no action

Project implementation will meet or move toward desired visual quality objectives in the 1986 forest plan. Timber harvest and road construction/reconstruction would continue to occur on the landscape: approximately 33 percent of the forest is in MAs 6a-c general forest area (low, moderate and high intensity), with 21 percent in general forest high intensity on the forest. Combining designated wilderness and recommended wilderness, approximately 49 percent of the forest would not be available for timber production or timber harvest. Refer to figure 1-50 for alternative A's scenic integrity objective map.

For alternative A, a cross-walk between the visual quality objectives of the visual management system and the scenic integrity objectives (see table 17 earlier in this section) was made.

Alternative A (table 21) has a higher percentage of low scenic integrity objectives than the other 3 alternatives. Both alternatives A and D have the same percentage in very high (46 percent) but less than alternatives B and C.

Table 21. Scenic integrity objectives (and corresponding visual quality objectives) for alternative A in percent of Forest

Scenic Integrity Objective (Visual Quality Objectives)	Area of Forest (%)
Very High (Preservation)	46
High (Retention)	13
Moderate (Partial Retention)	8
Low (Modification)	33

Alternative B

Project implementation will meet or move toward desired scenic integrity objectives. Timber harvest and road construction/reconstruction would continue to occur on the landscape: approximately 30 percent of the forest is in general forest area (low, moderate and high intensity), with 7 percent in the general forest high intensity on the forest. Combining designated wilderness and recommended wilderness, approximately 53 percent of the forest would not be available for timber production or timber harvest. Refer to figure B-26 for alternative B scenic integrity objectives.

Alternative B (shown in table 22) has higher acreage in very high and high scenic integrity objectives than alternatives A and D but less than alternative C.

Table 22. Scenic integrity objectives in percent of Forest for alternative B

Scenic Integrity Objective	Area of Forest (%)
Very High	53
High	16
Moderate	13

Scenic Integrity Objective	Area of Forest (%)
Low	18

Alternative C

Project implementation will meet or move toward desired scenic integrity objectives. Timber harvest and road construction/reconstruction would continue to occur on the landscape: approximately 25 percent of the forest is in general forest area (low, moderate and high intensity), with 5 percent in the general forest high intensity on the forest. Combining designated wilderness and recommended wilderness, approximately 66 percent of the forest would not be available for timber production or timber harvest. Refer to figure B-27 for alternative C scenic integrity objective map.

Alternative C (shown in table 23) has the highest acreage in very high, and high scenic integrity objectives of all the alternatives and the lowest amount in the low scenic integrity objective.

Table 23. Scenic integrity objectives of the Flathead National Forest in percent of forest for alternative C

Scenic Integrity objective	Area of Forest (percent)
Very High	66
High	9
Moderate	11
Low	14

Alternative D

Project implementation will meet or move toward desired scenic integrity objectives. Timber harvest and road construction/reconstruction would continue to occur on the landscape. Approximately 30 percent of the forest is in general forest area (low, moderate and high intensity), with 12 percent in the general forest high intensity on the forest. Designated wilderness is approximately 45 percent of the forest (there is no recommended wilderness in this alternative) would not be available for timber production or timber harvest.

Alternative D has an equal amount in very high scenic integrity objective as alternative A. Alternative D has more acreage in the low scenic integrity objective that alternatives B and C and less than A for the low scenic integrity objective. Refer to Figure B-27 for alternative D scenic integrity objective map.

Table 24. Scenic integrity levels of the Flathead National Forest in percent of forest for alternative D

Scenic Integrity Objective	Area of Forest (percent)
Very High	46
High	20
Moderate	12
Low	22

Consequences to scenery from forest plan components associated with other resource programs or revision topics

Effects of MA allocation

Alternative C contains the most amounts of very high scenic integrity objectives primarily due to the alternative C having the most amount of designated and recommended wilderness. It also has the lowest amount of low scenic integrity objectives. Alternative A has the most amount of acres assigned to the low scenic integrity objectives, followed by alternative D, then alternative B, and alternative C.

Effects from fire and fuel management

Blackened vegetation and soil, charred tree trunks and red needles on dead trees would be the main visual effect from fire which would decrease in time. In areas where fires suppression occurred with the use mechanical equipment, visual contrast from fire line construction could be evident depending on slope, the amount of vegetation removed by the fire, and the amount of mineral dirt exposed. Some effects from fire in fire-adapted ecosystems may be beneficial to scenery and include increased overall visual diversity, by resulting mosaics of vegetative types that reflect natural conditions. Alternative C would have the least impact from fire and fuel management because this alternative would achieve desired conditions for wildlife and other resources though greater use of natural ecosystem processes, such as planned and unplanned fire ignitions.

Effects from vegetation management and roads

Commercial timber harvest activities may result in road construction and reconstruction. New road construction is likely to be limited and temporary road construction used as a more common method for short-term access needs. Timber harvesting has a variety of effects that may be evident to visitors based on the type of logging system used, type of silvicultural treatment, the slope and visibility from roads and trails. Road construction may introduce unnatural visual elements into the landscape resulting in form, line, color and texture contrasts.

Because general forest MA (6b and 6c) allocations are the least amount in alternative C, which has a greater emphasis the use of natural ecosystem processes rather than mechanized methods to achieve desired conditions, it would be expected that alternative C would result in the least amount of vegetation management activities and lower amount of road constructed/reconstructed compared (respectively) has to alternatives B, A, and D.

Effects from minerals management

Mining activities can involve major landform alteration, as well as form, line, color and texture contrasts, resulting in adverse scenic impacts. Most lands outside of designated wilderness would be suitable for mineral in all alternatives. Therefore, the impacts from mineral management would be similar in all 4 alternatives.

Cumulative effects

Areas modified by timber harvest will continue to appear highly managed over the next 10 to 15 years and scenic integrity will remain low to very low in those areas. Timber harvest on adjacent private, state and federal lands may influence overall scenic integrity in northwestern Montana. Fuel reduction treatments in the urban interface may also add to these effects. However, the scenic backdrop above the valleys will remain generally unchanged regardless of alternative. Driving for pleasure and other scenery dependent activities on the Flathead National Forest could be affected slightly by human disturbance to areas under other administrations. Wildland fire and other

disturbance processes, if large in scale and intensity, may result in lowered scenic attractiveness for a few years in those areas affected by the disturbance. These effects cannot be predicted or analyzed, and the area would naturally recover over time.

3.11 Infrastructure

3.11.1 Introduction

3.11.2 Legal and administrative framework

Law and executive orders

Term Permit Act of March 4, 1915 (P.L. 63-293, Ch. 144, 38 Stat. 1101, as amended; 16 U.S.C. 497): This act provides direction to the NFS lands to authorize occupancy for a wide variety of uses through permits not exceeding 30 years.

National Forest Roads and Trails Act of October 13, 1964 (P.L. 88-657, 78 Stat. 1089, as amended): This act declared that an adequate system of roads and trails be constructed and maintained to meet the increasing demand for recreation and other uses. This act authorizes road and trail systems for the national forests. It authorizes granting of easements across NFS lands, construction and financing of maximum economy roads (Forest Service Manual 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

Highway Safety Act of September 9, 1966 (P.L. 89-564, 80 Stat. 731, as amended): This act authorizes state and local governments and participating federal agencies to identify and survey accident locations; to design, construct, and maintain roads in accordance with safety standards; to apply sound traffic control principles and standards; and to promote pedestrian safety. The Highway Safety Improvement Program and the Safety Performance Management Measures Final Rules (effective April 14, 2016) addresses the requirements of the Moving Ahead for Progress in the 21st Century Act and the Fixing America's Surface Transportation Act. The Highway Safety Improvement Program Final Rule updates the existing Highway Safety Improvement Program requirements under 23 CFR 924 to be consistent with Moving Ahead for Progress in the 21st Century Act and the Fixing America's Surface Transportation Act, and to clarify existing program requirements. The Safety Performance Management Measures Final Rule adds part 490 to title 23 of the CFR to implement the performance management requirements under 23 U.S.C. 150, including the specific safety performance measure requirements for the purpose of carrying out the Highway Safety Improvement Program to assess serious injuries and fatalities on all public roads.

Federal Aid Highway Act of 1968, as amended (23 U.S.C. 109(a) and (h), 144, 151, 319, and 351): Establishes the National Bridge Inspection Standards (23 CFR Part 650, Subpart C) and the requirement that each state have a current inventory of bridges on all public roads, including NFS roads open to public travel (Forest Service Manual 1535.11).

Surface Transportation Assistance Act of 1978 (P.L. 95-599, as amended). Supersedes the Forest Highway Act of 1958: Authorizes appropriations for forest highways and public lands highways. Establishes criteria for forest highways; defines forest roads, forest development roads, and forest development trails (referred to as "NFS roads" and "NFS trails" in Forest Service regulations and directives); and limits the size of projects performed by Forest Service employees on forest roads. Establishes the Federal Lands Highway Program

Moving Ahead for Progress in the 21st-Century Act of July 6, 2012 (P.L. 112-141): Replaces the Federal Lands Highway Program with the Federal Lands Transportation Program and Federal Lands Access Program. This act authorizes funding for federal lands transportation facilities and federal lands access transportation facilities under a unified program with policy similar to federal-aid highways and other public transportation facilities. It requires federal land management agencies to identify a comprehensive inventory of public federal lands transportation facilities that, at a minimum, includes the transportation facilities that provide access to high-use federal recreation sites or federal economic generators.

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (P. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): This act provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure, implement stewardship objectives that enhance forest ecosystems, and restore and improve land health and water quality.

National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide, April 2012: The first volume of guidance for the Forest Service, U.S. Department of Agriculture, and National Best Management Practices Program. The National Best Management Practices Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act and state water quality programs. Current Forest Service policy directs compliance with required Federal Clean Water Act permits and state regulations and requires the use of National Best Management Practices Program to control nonpoint source pollution to meet applicable water quality standards and other Federal Clean Water Act requirements. It includes road management activity National Best Management Practices Program for construction, operation, and maintenance for roads and motorized trails.

3.11.3 Methodology and analysis process

Information sources

Information used to conduct the analysis generally comes from the national infrastructure database. This database is a collection of Web-based data entry forms, reporting tools, and mapping tools (geographic information system) that enable forests to manage and report accurate information about their inventory of constructed features and land units.

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years).

3.11.4 Affected environment (existing condition)

Forest system roads

The transportation system for the Flathead National Forest is defined as the system of NFS roads, NFS trails, and airfields on NFS lands (36 CFR 212.1). This section covers the existing condition of the NFS roads. Please see the recreation and access section for discussion on access and effects to NFS trails and motorized over-snow vehicle use.

NFS roads are roads, under the jurisdiction of the Forest Service, wholly or partly within or adjacent to and serving the NFS that the Forest Service determines is necessary for the protection, administration, and utilization of the NFS and the use and development of its resources. Roads managed by public road agencies such as States, counties and municipalities that help provide for access to NFS lands are also informally considered part of the overall regional transportation system, but do not fall under the jurisdiction or direction of the National Forest. These roads will not be included in this evaluation.

NFS roads are designated by the design (vehicle classifications and use) and maintenance standards for each road. Roads are generally constructed and maintained wide enough (>12 feet) for typical cars and trucks. Since many of the roads were initially constructed for vegetation management objectives, the design vehicles were lowboys or logging trucks. Roads are built to grades usually less that 12 percent to allow grade-ability for most highway vehicles. The Forest Service uses five maintenance levels to define the general design standards, use, and associated type of maintenance required. These five maintenance levels can be described as:

- Maintenance level 1. These are roads that have been placed in storage between intermittent uses. The period of storage must exceed one year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Roads managed at this maintenance level are described as being in basic custodial care.

- Maintenance level 2. Assigned to roads open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are generally not provided. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or more of a combination of administrative, permitted, dispersed recreation, or other specialized uses. Roads managed at this maintenance level are described as high clearance vehicle roads.

- Maintenance level 3. 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 with single lanes and turnouts and are included in the term “passenger car” roads.

- Maintenance level 4. Assigned to roads that provide a moderate degree of user comfort and convenience at slow to 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.

- Maintenance level 5. Assigned to roads that provide a high level of user comfort and convenience at slow to moderate travel speeds. The roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated.

Maintenance level 3 through 5 roads are collectively maintained for travel by a prudent driver in a standard passenger car. These roads fall under the requirements of the National Highway Safety Act and the Manual of Uniform Traffic Control Devices. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations.

Forestwide, there are 3,566 miles of NFS roads; 60 percent (2,135 miles) of the NFS roads are in custodial care (closed to public motorized use); 40 percent (1,431 miles) are open to public motorized use (either yearlong or seasonally), with 33 percent being open for high clearance vehicles and 66 percent are open for passenger car. The following tables (table 25, table 26, table 27, and table 28) provide information related to the distribution of roads on the Forest by maintenance level grouping (basic custodial care, high clearance vehicles, and passenger car) and availability for public motor vehicle use.

Table 25. Percentage of NFS roads by maintenance level grouping on the Forest, primary conservation area (PCA) and zone 1

Area	Basic Custodial Care (%)	High Clearance vehicles (%)	Passenger Car (%)
Forest	59	14	27
PCA	64	10	26
Salish DCA	42	29	29
Zone 1, outside DCA	54	18	28

Table 26. Miles of NFS roads open to the public by maintenance level on the Forest, primary conservation area (PCA) and zone 1

Area	Basic Custodial Care (mi)	High Clearance vehicles (mi)	Passenger Car (mi)
Forest	4	475	951
PCA	3	215	606
Salish DCA	<1	110	112
Zone 1, outside DCA	1	138	138

Table 27. Miles of NFS roads closed to the public by maintenance level on the Forest, primary conservation area (PCA) and zone 1

Area	Basic Custodial Care	High Clearance vehicles	Passenger Car
Forest	2094	25	2
PCA	1486	19	2
Salish DCA	158	0	0
Zone 1, outside DCA	407	3	0

Table 28. Miles of NFS roads receiving maintenance, percentage of passenger car system and high clearance car system receiving maintenance, on the Forest for the last five years

Year	Miles of NFS roads Receiving Maintenance	% of Passenger Car System Receiving Maintenance	% of High Clearance Car System Receiving Maintenance
2015	494	73	16
2014	401	66	14
2013	690	62	4
2012	691	62	2
2011	1,446	99	22
2010	1,454	99	20

As shown in table 29, the total number of roads on the Forest has steadily been decreasing since 1995. A total of about 787 miles of NFS roads and non-system roads have been decommissioned during this time. Most of this decommissioning has taken place in grizzly bear recovery areas. However, there were additions to the NFS road system. These additions included constructing new roads for vegetation management (19 miles), acquisition related to cooperative road right-of-way agreements with the Montana Department of Natural Resource Conservation, Plum Creek Timber Company acquisition (411 miles), and database cleanup. The majority of the increase due to the acquisition of previously Plum Creek Timber Company lands located in the Swan Valley.

Table 29. Miles of NFS and non-NFS road decommissioned from 2004 to 2015 on the Forest

Decommissioned Roads	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Miles	42	28	47	42	48	22	55	12	13	4	13	25

Aviation

There are four existing open airstrips on the Forest that are available for public use: Schafer Airstrip (wilderness airstrip), Meadow Creek Airstrip along the South Fork of the Flathead, Spotted Bear Airstrip and Condon Airstrip. There are 20 airstrips in the Flathead valley area that may be available for public use. In the state of Montana, in 2011 there were 258 total airstrips: 121 are open for public use, 15 are commercial service airports and 134 are private airstrips (FAA US Civil Airman Statistics).

3.11.5 Environmental consequences

Alternative A – no action

The no action alternative fully implements amendment 19 of the Flathead National Forest. This amendment requires that grizzly bear subunits that have ≥75 percent of NFS lands must meet the following direction:

- Open route density. ≤19 percent of subunit to be ≤1.0 mile/square mile.
- Total route density. ≤19 percent of subunits to be ≤2.0 miles/square mile.
- Security core. ≥68 percent of subunit to be in core as defined as:
  - 500 meters from highways, county and private roads, open/gated route, motorized route, or high-use trail
  - ≥ 2,500 acres in size.

To achieve this direction, an estimated 518 miles of road would need to be reclaimed, and either on the transportation system as impassable or off the transportation system as decommissioned. About 57 miles of trails would no longer allow motorized wheeled use in order to fully meet amendment 19 in each grizzly bear subunit, unless site-specifically amended. These figures are an estimated programmatic assessment of the number of miles needed to meet amendment 19 management direction. The actual number may be higher or lower depending upon changing access condition on adjacent lands and the site specific factors that must be considered when evaluating access and grizzly bear habitat needs. About 79 miles of roads that are open either yearlong or seasonally

would be closed to public use. This alternative would provide the least opportunity for wheeled motor vehicle use (allowed on designated roads) on 1,262 miles of the Forest.

Amendment 19 does not apply to portions of the Salish Mountain GA west of Highway 93; therefore motorized use would not be reduced there.

The Forest's trail system would increase by roughly 25 miles because the trailheads would be relocated to where the road ends. This would be an increase in non-motorized trails. Table 30 and table 31 provide additional information in support the above discussion.

Table 30. List of grizzly bear subunits and the estimated miles of NFS road closures to meet forest plan direction

Grizzly Bear Subunit Name	Estimated miles of road to close to meet 68% or amended
Hay Creek	11
Canyon McGuinnis	2
Peters Ridge	10
Swan Lake	9
Crane Mountain	33
Beaver Creek	13
Emery Firefighter	9
Logan Dry Park	19
Skyland Challenge	4
Buck Holland	40
Cold Jim	68
Glacier Loon	56
Hemlock Elk	25
Lion Creek	36
Meadow Smith	58
Piper Creek	43

1. Lion Creek grizzly bear subunit still does not meet the motorized access standards even with this reduction in miles.

Table 31. Summary of travel management actions needed to meet motorized access direction in all subunits, unless amended.

Current Travel Management	Potential Travel Management[1]	Miles
Open yearlong/seasonal roads	Closed yearlong by gate (allows administrative use)	7
Open yearlong/seasonal roads	Closed yearlong by physical barrier (does not allows administrative use)	55
Open yearlong/seasonal roads	To be reclaimed/decommissioned	17
Closed yearlong signed/gated roads	Closed by physical barrier (does not allow administrative use)	91
Gated yearlong roads	Made reclaimed/impassable (11 miles[2]) or reclaimed/decommissioned (269 miles)	280

Current Travel Management	Potential Travel Management[1]	Miles
Roads with physical barriers	Made reclaimed/impassable (14 miles[2]) or reclaimed/decommissioned (201 miles)	215
Currently impassable roads	To be reclaimed/decommissioned	30

1 Simulated model of potential changes to fully meet 19-19-68 or amended.
2 These road miles would be reclaimed and left on the transportation system.

Alternative B

Because the Flathead National Forest needs to continue to support a recovered NCDE grizzly bear population, roads open to public motorized use in the Salish GA would not exceed baseline levels.

Grizzly bear subunits in the primary conservation area would need to maintain or be below baseline levels for motorized road access. This alternative and alternative D would provide the most opportunity for wheeled motor vehicle use (allowed on designated roads) on 1,431 miles of the Forest.

Alternative C

Because the Forest needs to continue to support a recovered NCDE grizzly bear population, roads open to public motorized use in the Salish Mountain GA would not exceed baseline levels, but some additional motorized trail access could occur in zone 1 including the Salish demographic connectivity areas. For the primary conservation area subunits, motorized access standard would not need additional road closures, but the baseline levels that supported a recovered grizzly bear population would be maintained.

However, in alternative C, existing wheeled motorized use would not be suitable in recommended wilderness areas, therefore reducing the amount of motorized opportunity for wheeled motor vehicle by 75 miles on the Forest; providing a wheeled motor vehicle use (allowed on designated roads) on 1,356 miles of the Forest. This alternative provides more wheeled motor vehicle use (allowable on designated roads) than alternative A, but less than alternatives B and D.

In addition, about 30 miles of closed roads (maintenance level 1) that are currently within the recommended wilderness areas may need to be to be removed from the system after site-specific analysis.

Alternative D

This alternative has the highest amount of timber production from suitable timberlands. There are 641,543 acres (27 percent) suited for timber production on the Forest. The current road system would be sufficient for this level of timber production with use of temporary roads.

Because the Forest needs to continue to support a recovered NCDE grizzly bear population, roads open to public motorized use in the Salish GA would not exceed baseline levels, but some additional motorized trail access could occur in zone 1 including the Salish Demographic connectivity areas. Primary conservation areas grizzly bear subunits that do not yet meet the 19-19-68 motorized access standards would not need additional road closures, but the baseline levels that supported a recovered grizzly bear population would be maintained.

Alternative D would provide the opportunity for wheeled motor vehicle use (allowed on designated roads) on 1,431 miles of the Forest. This alternative and alternative B would provide the most

opportunity for wheeled motor vehicle use (allowed on designated roads) on 1,431 miles of the Forest.

Aviation

This alternative includes a suitability plan component for new airstrip development in desired recreational opportunity spectrum class of roaded natural in the MAs general forest area moderate (6b) and general forest area high (6c). There is 590,034 acres of roaded natural in MA 6b and 6c.

Consequences to infrastructure from forest plan components associated with other resource programs

Effects of management allocation

Road maintenance (both recurrent and deferred) will continue to occur, as funding allows. Physical conditions will continue to be addressed through maintenance activities and be based on public health and safety, resource protection, and mission priorities. Annual operating budgets and supplemental funding will likely fluctuate, resulting in varying maintenance accomplishments from year to year.

The condition (e.g., drivability) of roads may vary between alternatives. This is mainly a result of the variability of road maintenance work that might be accomplished under the four alternatives. Since alternative C has the least amount of acres allocated to general forest (management area 6a-c), fewer road maintenance activities may be accomplished because commercial use and associated maintenance is expected to be less. Under alternative D, which has the most acres allocated to general forest, more commercial use might be expected and may result in the greatest amount of road maintenance.

Routine road maintenance work (brushing, blading, ditch and culvert cleaning, etc.) is periodically performed on approximately 3,637 miles of maintenance level 2, 3, 4, and 5 roads as funding allows and in most cases they are kept in a drivable condition for their designed use. The approximately 2,094 miles in maintenance level 1 (which includes roads treated for intermittent stored service), however, do not receive routine maintenance work. The drivability of these maintenance level 1 roads can be expected to continue to diminish as roads re-vegetate.

Effects from vegetation management

Commercial timber harvest activities will generally result in road maintenance, reconstruction and continued application of best management practices on existing NFS roads. New road construction is likely to be limited and temporary road construction used as a more common method for short-term access needs.

Administrative use of gated roads that normally prohibit motor vehicle use yearlong is likely when management activities such as pre-commercial thinning, invasive weed treatments, or other non-commercial silvicultural treatments are planned.

Because general forest (MA6a-c) allocations are lowest in alternative C, it would generally be expected to result in the least amount of vegetation management activities and result in a lower amount of road use compared (respectively) to alternatives B, A, and D. Consequently, reduced traffic (i.e., number of vehicles on roads), both commercial and administrative, can be expected for alternative C. Associated with reduced commercial use is the reduction of road reconstruction to standard and best management practices work. Road maintenance activities done in conjunction

with commercial use would also occur less often since this work is only required commensurate with use.

Effects from fire and fuels management

Fuels management activities (e.g., prescribed burning) and fire suppression actions are likely to continue. Administrative use of gated roads that normally prohibit motor vehicle use yearlong is likely when these management activities occur.

Fire suppression actions are also likely to continue and could result in the use of gated roads as described above. In some cases, roads in storage (maintenance level 1) that are impassible to motor vehicle use (due to re-vegetation or other restrictive condition) may be opened in order to facilitate suppression actions. These roads would probably be used for the duration of the suppression efforts and post-fire work and then returned to their previous status.

Effects from wildlife management

All alternatives support a recovered grizzly bear population. For example, all alternatives retain levels of open or total road densities and secure core that have supported grizzly bear recovery on the Flathead National Forest. Alternatives differ in the range of future actions that could occur. Alternative A would close additional miles of motorized roads. Alternative B would continue the baseline roads. Alternative C would greatly increase the amount of recommended wilderness and would not require additional road closures, while alternative D would not recommend any areas for recommended wilderness and not require additional road closures.

Alternatives B and D would allow the greatest temporary increases in motorized access for projects in the primary conservation areas, as these two alternatives have the greatest number of acres in MA 6b and 6c. Alternative C would allow the least temporary increase in motorized access for projects in the primary conservation area as this alternative has the lowest number of acres in MA 6b and 6c and the highest number of acres in recommended wilderness and non-motorized backcountry MAs. In alternative A, there would be very few temporary changes in motorized access due to projects in security core (with the exception of emergency access) and very few changes in areas with decommissioned roads. There would be temporary increases in motorized access for projects on gated roads.

Effects from mineral management

The Forest Service does not initiate exploration or development of mineral or energy resources. Proposals for exploration and development are driven by external parties and market forces and regulated by existing mining law. Access and road development (long-term or temporary) is often associated with mineral exploration and development, but a site-specific analysis is required prior to any approval for exploration or development activities.

If any mine reclamation activities occur they would likely use existing roads. These may be roads that are not currently designated for motor vehicle use. They would probably be used for the duration of the reclamation work and then returned to their previous status.

Effects from aquatic management

Watershed improvement activities are likely to continue. The consequences to motor vehicle access can be expected to be minimal. One activity that may occur on roads that are generally not designated for motor vehicle use is treating roads to reduce sediment production and transport to surface waters or to provide for aquatic organism passage. Actions taken might be culvert removal, out-sloping of road prisms, or the removal of unstable fills. Any roads receiving these types of

treatments are generally no longer drivable. On occasion, these treatments may be completed on roads that are currently designated for motor vehicle use but this is expected to occur infrequently.

Cumulative effects

Access across the Forest is likely to be influenced by a variety of factors. Given the mixed land ownership (state lands, corporate timberlands) in and around the Forest and the continuing management actions taken on these lands, there may be options for new access opportunities through cooperative and cost-share agreements.

Commercial traffic (timber hauling) can be expected to fluctuate to some degree, relative to vegetation management activities. Market conditions and other external factors can often influence activity levels. These traffic conditions are usually limited to relatively small geographic areas and short periods of time. Hauling occurs more often during the summer months, but is not uncommon during the winter months as well.

Change in ownership of private lands can result in continued requests for road access across NFS lands. Depending on the circumstances, these may be requests for Forest or private road special use authorization. Depending on the terms and conditions written into any new authorizations, opportunities for access to NFS lands may be created.

State and local government agencies with road management authority can be expected to continue to maintain their existing road network across the Forest. Some changes such as widening, resurfacing, and bridge replacements are probable but are dependent on budgets and funding allocations. The likelihood of jurisdiction of NFS roads being passed to other public road agencies is low.

3.12 Lands and Special Uses

3.12.1 Introduction

This section addresses land ownership administration and adjustments and special uses of NFS lands on the Forest. Management of NFS land includes survey and marking of boundaries, acquisition and exchange of lands, handling of title claims and encroachments, acquisition of rights-of-way, and authorization and management of special uses to protect resource values and interest of the Federal Government.

Adjustments of land ownership can occur through congressionally mandated conveyances, exchanges, and acquisitions, or through Forest Service administrative activities.

The objectives of the Forest Service land ownership adjustment program (Forest Service Manual 5402) are to:

- Achieve the optimum land ownership pattern to provide for the protection and management of resource uses to meet the needs of the nation now and in the future;
- Avoid land use conflicts with non-federal landowners by settling land claims equitably and promptly; and
- Provide resource administrators readily accessible and understandable title information affecting the status and use of lands and resources they administer.

Land occupancy and use by private parties and other government entities is managed through the issuance of special use authorizations. Authorized special uses on the Flathead include industrial or commercial uses, private uses, and a variety of recreational uses.

All occupancy, use, or improvements on NFS lands that are not directly related to timber harvest, grazing, mining activities, and recreation are referred to as 'non-recreation special uses.' Typically, non-recreation special uses includes: roads, utilities, storage facilities, communications sites, research, and commercial filming. Recreation special uses include: resorts, ski areas, outfitter and guides, and a variety of uses that provide access to NFS lands by commercial ventures.

Use and occupancy of NFS lands may be authorized when such use is determined to be in the public interest.

3.12.2 Legal and administrative framework

The following is a select set of statutory authorities that govern landownership adjustments and the issuance and administration of special use authorizations on the Flathead National Forest. They are briefly identified/described below to provide context to the management and evaluation of these resources. There are multiple other laws, regulations and policies not described below that also guide the management of these programs; see Forest Service manuals 2700, 5400, and 5500 for a comprehensive listing.

Law and executive orders

Organic Administration Act of June 4, 1897 (16 U.S.C. 477-482, 551): This act authorizes the Secretary of Agriculture to issue rules and regulations for the occupancy and use of the national forests. This is the basic authority for authorizing use of NFS lands for other than rights-of-way.

Preservation of American Antiquities Act of June 8, 1906 (16 U.S.C. § 431 et seq.): This act authorizes permits for archeological and paleontological exploration involving excavation, removal, and storage of objects of antiquity or permits necessary for investigative work requiring site disturbance or sampling which results in the collection of such objects.

Occupancy Permits Act of March 4, 1915 (16 U.S.C. § 497 et seq.) as amended: This act authorizes use and occupancy on national forest land for recreational purposes including resorts and recreation residences.

General Exchange Act of March 20, 1922 (16 U.S.C. 485, 486): This act authorized the Forest Service to consolidate its holdings in national forests where a large percentage of private lands were intermingled with forest lands. It made possible the exchange of inholdings within national forests for private lands of equal value and within the same state.

Section 7 of the Granger-Thye Act of April 24, 1950 (16 U.S.C. 490, 504, 504a, 555, 557, 571c, 572, 579a, 580c-5801, 581i-1): This act authorizes special-use permits not to exceed 30 years duration for the use of structures or improvements under the administrative control of the Forest Service and for the use of land in connection therewith, without acreage limitation.

Highway Act of August 27, 1958 (23 U.S.C. 317), supplemented by the Act of October 15, 1966 (49 U.S.C. 1651): This act authorizes the Federal Highway Administration to grant easements to States for highways that are part of the federal-aid system or that are constructed under the provision of chapter 2 of the Highway Act. The Forest Service consents to the grant of these easements in a form agreed upon by the two agencies and upon the state highway agency's

execution of stipulations. This is the only authority for granting rights-of-way for projects on the federal-aid system or projects constructed under the provisions of chapter 2 of the Highway Act (Forest Service Manual 2731).

Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136): This act establishes requirements for special use authorizations in designated wilderness areas for temporary structures, commercial public services and access to valid mining claims and non-federal lands. Under this act, Presidential approval is necessary for the establishment of new water facilities, power projects, and transmission lines. Except for the Alaska National Interest Lands Conservation Act of December 2, 1980, this act is the exclusive authority for rights-of-way occurring within designated wilderness areas.

Land and Water Conservation Fund Act of September 3, 1964, as amended (16 U.S.C. 4601-6a(c)): Section 4(c) of this act authorizes permits for recreation, such as group activities, organized events, motorized recreational vehicle use, and other specialized recreation activities of limited duration.

National Forest Roads and Trails Act of October 13, 1964 (16 U.S.C. 532-38): This act authorizes the Secretary of Agriculture to grant temporary or permanent easements to landowners who join the Forest Service in providing a permanent road system that serves lands administered by the Forest Service and lands or resources of the landowner. It also authorizes the grant of easements to public road agencies for public roads that are not a part of the federal-aid system (Forest Service Manual 2732).

Sisk Act of December 4, 1967, as amended (16 U.S.C. 484a): This act authorizes the exchange of lands with states and local governments.

National Environmental Policy Act of January 1, 1970 (42 U.S.C. 4321, 4331-4335, 4341-4347): This act directs all agencies of the Federal Government to utilize a systematic interdisciplinary approach to ensure the integrated use of the natural and social sciences in planning and decision making which may have an impact on man's environment.

The Act of November 16, 1973 (30 U.S.C. 185): This act, amending Section 28 of the 1920 Mineral Leasing Act, authorizes the Forest Service to issue authorizations for oil and gas pipelines and related facilities located wholly on NFS land. When the lands are under the jurisdiction of two or more federal agencies, authority for issuance is reserved to the USDI, Bureau of Land Management, subject to approval by the agencies involved.

Endangered Species Act of 1973 (16 U.S.C. 1531-1536, 1538-1540): This act provides for the conservation of endangered and threatened species and their habitats.

Federal Land Policy and Management Act of October 21, 1976 (43 U.S.C. 1761-1771): Title V of the Federal Land Policy and Management Act (FLPMA) authorizes the Secretary of Agriculture to issue permits, leases, or easements to occupy, use, or traverse NFS lands. FLPMA directs the United States to receive fair market value unless otherwise provided for by statute and provides for reimbursement of administrative costs in addition to the collection of land use fees (43 U.S.C. 1764(g)).

Alaska National Interest Lands Conservation Act of 1980 (16 U.S.C 3210):

a) The Alaska National Interest Lands Conservation Act (ANILCA) provides numerous authorities related to access that are specific to national forests in Alaska (except for sec. 1323(a), which applies to all NFS lands; see the following paragraph b). The Regional

Forester, Region 10, shall prepare Manual supplements providing necessary direction for Alaska.

b) The provisions of section 1323(a) (16 U.S.C. 3210) apply to all NFS lands. This section provides that, subject to terms and conditions established by the Secretary of Agriculture, the owners of non-federal land within the NFS shall be provided adequate access to their land. Regulations implementing section 1323(a) are set forth at Title 36, Code of Federal Regulations, Part 251, and Subpart D -Access to Non-federal Lands. See Forest Service Manual 2701.3, paragraph 3, for the summary of the provisions of 36 CFR 251, Subpart D.

Small Tracts Act of January 12, 1983 (16U.S.C. 521c-521i): This act authorizes the sale, exchange, or interchange of certain parcels of minimal size.

National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b): This Act authorizes the Secretary of Agriculture to issue permits for ski areas and other snow sports and recreation uses on NFS lands.

Act of May 26, 2000 (16 U.S.C. 406l-6d): This act supplements the authority of the Secretary of Agriculture to regulate commercial filming and still photography on NFS lands. It also authorizes the Secretary to retain and spend land use fees collected for commercial filming and still photography without further appropriation, and provides for recovery of administrative and personnel costs in addition to the collection of the land use fee.

Federal Lands Recreation Enhancement Act (16 U.S.C. 6801-6814): This Act authorizes the Forest Service to charge standard and expanded amenity recreation fees and to require and charge fees for special recreation permits. Fee revenues may be retained and spent by the Forest Service in accordance with the Act's requirements.

Cabin Fee Act of December 22, 2014 (16 U.S.C. 3193, 6901, 6201): This Act directed the Forest Service to modify the Recreation Residence Program as the program applies to units of the NFS derived from the public domain by implementing a simple, equitable, and predictable procedure for determining cabin user fees. Code of Federal Regulations (CFR)

The following regulations provide direction for special uses management on NFS lands:

- **36 CFR 251** — Land Uses. Subparts A: Miscellaneous Land Uses; B: Special Uses; C: Appeal of Decisions Relating to Occupancy and Use of NFS Lands; D: Access to Non-Federal Lands; and E: Revenue-producing Visitor Services in Alaska.
- **36 CFR 254** — Landownership Adjustments. Subparts A: Land Exchanges; B: National Forest Townsites; C: Conveyance of Small Tracts.

3.12.3 Key indicators

- Acres of NFS land administered; and
- Number of special use authorizations.

3.12.4 Methodology and analysis process

The number of acres of NFS lands currently administered by the Flathead and number of special use authorizations currently in effect would be compared to changes that would result from implementation of any of the alternatives considered.

The total acres of NFS lands are derived using a GIS measuring process. The total is comprised of lands under Forest Service jurisdiction both within and outside of the proclaimed NFS boundary. The total acres of non-NFS lands are provided by the Washington Office Lands group and are only those lands within the proclaimed NFS boundary. The data source for the number of special use authorizations is the national Special Uses Database System.

Information sources

The Forest Service uses the Land Status Record System (LSRS) as the repository for all realty records and land title documents. The LSRS includes accurate information on ownership acreages, condition of title, administrative jurisdiction, rights held by the United States, administrative and legal use restrictions, encumbrances, and access rights on land or interests in land in the NFS.

The Forest Service uses the Special Uses Data System to create and administer special use authorizations. The data in SUDS is supported by hard copy files at Ranger District and Forest Supervisor's offices.

Incomplete and unavailable information

There is not any incomplete or unavailable information pertinent to lands and special uses.

3.12.5 Affected environment (existing condition)

Lands

There are 2,413,573 acres of NFS lands that are the administrative responsibility of the Forest. This is the result of the original Congressionally-designated lands and the conveyances (acquisitions, disposals, and exchanges) that have occurred to date.

The Flathead landownership pattern varies with location (see figure 2).The pattern can be characterized as:

- Large blocks of uninterrupted, contiguous NFS lands;
- Isolated tracts of private lands surrounded by NFS lands;
- Isolated tracts of NFS lands surrounded by private lands; and
- Large blocks owned by corporate landowners.

Within the proclaimed boundaries of the Flathead, other individuals or entities own 237,215 acres. Landowners include the State of Montana, Plum Creek Timber Company Inc., The Nature Conservancy, the USFWS, and numerous private landowners.

Ownership

In 1986 when the current forest plan went into effect, the Flathead National Forest included 2,350,383 acres of NFS lands. Since then the Forest has acquired 63,190 acres of lands utilizing the Land and Water Conservation Fund, a Federal program set up for acquiring land and water, and easements on land and water for the benefit of all Americans. Most of these lands are in the Swan Valley and were acquired through the Montana Legacy Project and subsequent Land and Water Conservation Fund purchases by the United States. The Legacy Project included a large donation from The Nature Conservancy of land they purchased from Plum Creek Timber Company in partnership with the Trust for Public Land. This former Plum Creek land was intermingled with

NFS lands in a checkerboard pattern in the Swan Valley. This change to a mostly-NFS-lands ownership pattern, allows the Forest to manage its lands more effectively for multiple resources. If additional funding becomes available, the Forest can purchase the rest of the property that TNC has acquired from Plum Creek.

There have been other land acquisitions across the Forest utilizing Land and Water Conservation Fund funds. Additionally, the Forest periodically exchanges lands for the mutual benefit of each party. While there are still some areas of the Flathead that have intermingled ownerships of land, there are no significant acquisitions or exchanges of lands in process, partly due to decreased funding available.

Special uses

Some uses of NFS lands are covered by special use authorizations, including permits, leases, and easements that allow occupancy, use, rights, or privileges on the Flathead National Forest. Special use authorizations are legal instruments whose terms and conditions are fully enforceable when consistent with laws, regulations, and policies. The mission of the Forest Service Special Use Program is to manage the use and occupancy of NFS lands in a manner that protects natural resource values, promotes public health and safety, and is consistent with the forest plan.

The Flathead currently administers 563 special use permits, of which 142 are categorized as recreation permits and 421 are lands permits. Recreation permits range from outfitter/guide permits to developed ski areas and other resorts. There are two developed ski areas under permit on the Forest: Blacktail Mountain Ski Area west of the town of Lakeside in the Salish GA and Whitefish Mountain Resort north of the city of Whitefish, which borders the Salish and North Fork GAs.

Lands special uses range from permits for individuals to use NFS land for their driveways, to more extensive uses such as powerlines, fiber optic cable, telephone lines, and oil and gas pipelines that cover many miles of NFS lands. Other land uses under permits include communications towers, research studies, fences, signs, and service buildings.

Partial interests

Various parties hold partial land interests within and near the plan area, such as mineral rights or conservation easements. Over the life of the current forest plan, the Flathead has acquired 65 conservation easements on private lands in the plan area, under the authority of the Wild and Scenic Rivers Act. Of these, 58 were purchased or acquired as part of land exchanges, six were donated to the forest, and one was acquired through condemnation. Sixty-two of the conservation easements are in the Wild and Scenic River corridors of the North Fork and Middle Fork Rivers. The other three are in the Swan Valley.

The purpose of these easements is to maintain the integrity of the wild and scenic rivers. There are additional benefits to these conservation easements, such as the maintenance of fish and wildlife habitat.

Rights-of-way and easements affect both private and public lands throughout the plan area. The Flathead National Forest has reserved or acquired rights-of-way needed for public and administrative access and has granted private or other public entities rights-of-way for access across NFS lands.

Access

In this section, access refers to the legal rights-of-way acquired by the Forest Service, across non-NFS land for the management and use of NFS lands. Of the 2,413,573 acres of NFS lands, the Forest has legal access to all but approximately 850 acres of land in 11 parcels across the Forest. Those 11 parcels are scattered across the forest – two of them are on the North Fork of the Flathead, two of them are on the Middle Fork of the Flathead, and two of them are on the main stem of the Flathead River. Four other parcels are located in the Salish Mountains GA and one other parcel is located in the Swan Valley. While most of these parcels could be accessed legally from rivers, they are considered inaccessible since one cannot get to them by land. Other than the parcels noted above, all NFS lands on the Forest have legal access by road or trail to them.

3.12.6 Environmental consequences

Alternative A – no action

This alternative reflects the 1986 forest plan, as amended to date, and accounts for current laws and regulations that have been issued since the original forest plan and the amendments that were adopted. The 1986 forest plan recognized the desirability of adjusting landownership in order to improve manageability of NFS lands.

With this alternative, in the PCA and unless site-specifically amended, it is estimated that 518 miles of roads would need to be reclaimed, and either on the transportation system as impassable or off the transportation system as decommissioned. Additionally, 57 miles of motorized trails would need to be closed to motorized use. This reduction in access could impact on recreation special use permits.

Alternatives B, C, and D

None of the alternatives propose to make any site-specific changes to the existing land ownership on the Flathead. No conveyances (acquisitions, disposals, or exchanges) are proposed. Any of these actions would only be considered at the project level. Until an external entity presents a proposal there would be no changes to the existing landownership pattern.

Additional guidelines in the draft plan include:

- Special use authorizations in the primary conservation area should have permit requirements that reduce or limit the risk of grizzly bear-human conflicts.
- Within areas specifically identified as being important for wildlife connectivity across highways (see figure B-54), the USFS should cooperate with highway managers and other landowners to implement crossing designs that contribute to wildlife and public safety.

These guidelines would apply in alternatives B, C, and D.

Consequences to lands and special uses from forest plan components associated with other resource programs or revision topics

Effects from MA direction for alternatives B, C and D

Some MA allocations, such as NFS lands which have not been statutorily designated for a specific use (e.g., MA1b recommended wilderness, MA2b eligible wild and scenic rivers) or lands that have been administratively designated for a specific use (e.g., MA3 special areas, MA4a research natural

areas) are less likely to be considered for disposal or exchange. Based on MA allocations, alternative C would have the greatest number of acres that would be less likely to be considered for disposal or exchange, followed by alternative B, D, and A.

Alternative C also has different management direction for MA 1b recommended wilderness so that mechanized transport (e.g. mountain bikes) would not be suitable and in all areas suitable for over-snow motorized use, late season use (after March 31) would not be suitable, both of which could impact recreation special uses.

Similar to lands, some special uses authorizations are less likely to be considered in MA1b, MA2, MA3, or MA4. Based on MA allocations and the differing forest plan component direction, alternative C would have the greatest number of acres that would be less likely to be considered for special use authorizations, followed by alternative B, D, and A.

The focused recreation area MA 7 is a new designation in the draft forest plan. Focused recreation areas typically have certain types of recreation uses featured such as a large lake or reservoir, developed ski area or year-round resort, large campgrounds, or trail systems for featured recreational activities. These opportunities are provided in specific areas in response in increasing demand by local communities. This designation may result in increased demand for more commercial recreation uses then we have today and the increase in recreation special use authorizations for all action alternatives.

Effects from vegetation management

Vegetation treatments tend to impact the appraised value of NFS lands. Depending on the type of treatment the value may decrease or increase. Since alternative D has the most likelihood of vegetation treatments it is most likely to result in fluctuations in land values, followed by alternative A, B, and C.

Effects of wildlife management

NFS lands that provide secure habitat or contribute as linkage areas are less likely to be considered for disposal or exchange. The trend over the life of the current forest plan has been reduced motorized access by road across the Forest. There are a number of reasons that motorized access by road has been reduced on the Flathead, including to ensure adequate secure habitat for wildlife, the need to comply with the Amendment 19 of the 1986 forest plan, and other resource protection.

Based on effects of wildlife management, alternative C would have the greatest number of acres that would be less likely to be considered for special use authorizations, followed by alternative B, D, and A.

Effects from access and recreation management

NFS lands with developed recreation sites (e.g., campgrounds) are less likely to be considered for disposal or exchange.

Plan direction includes objectives to construct and designate the Whitefish Trail and Foy's To Blacktail Trails. The effect would be similar for all of the action alternatives B, C, and D, with potential for increased commercial guide permits than the no-action alternative A.

3.12.7 Cumulative effects

Cumulative effects evaluate the potential impacts to NFS lands and special uses from the proposed action when combined with past, present, and reasonably foreseeable actions. The lands within the

Forest boundary form the geographic scope for cumulative effects since this is the scope for the modified proposed action (alternative B). The temporal bound would be the life of the revised forest plan which is estimated to be a 15-year time span.

In order to integrate the contribution of past actions to the cumulative effects of the proposed action and alternatives, existing conditions are used as a proxy for the impacts of past actions. This is because existing conditions reflect the collective impact of all prior actions that have affected landownership and special uses and might contribute to cumulative effects. Landownership and special uses can be expected to be influenced by a variety of factors.

As described in the affected environment section, the Flathead has administrative responsibilities for 2,413,573 acres of NFS lands. Adjustments in landownership on the Forest will continue, including a proposal for the purchase of 3 parcels utilizing the Land and Water Conservation Fund and the sale of an administrative site, both expected in 2017. External entities have made land acquisitions and have held them until they can be conveyed to the national forests; and it is likely that these types of actions may continue. Any change (increase or decrease in total NFS lands) is dependent on what actions might be initiated. Outright purchase and transfer would most likely result in an increase in the acres of NFS lands. Land exchanges, on the other hand, may result in a decrease in the acres of NFS lands.

The Forest can expect requests for special use authorizations to increase. As more private land is subdivided there is usually an associated increase in requests for special use authorizations such as road and utilities. Requests for modification of existing authorized communication sites and designation of new communication sites can reasonably be expected as technological advances (e.g., cell phones) are made. On the Flathead these sites typically occupy small acreages (1 to 2 acres).

Boundary survey and marking will continue and encroachments are likely to be discovered.

3.12.8 Effects determination

Since no specific changes in landownership are proposed, the number of acres of NFS lands remains the same for all four alternatives. None of the alternatives propose to make any site-specific changes to existing special use authorizations or rights-of-way on the Forest.

3.13 Designated Wilderness

3.13.1 Introduction

In 1964, Congress passed the Wilderness Act of 1964 (P.L. 88-577) and defined wilderness as a place “in contrast with those areas where man and his own works dominate the landscape… where earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain… an area of undeveloped Federal lands retaining its primeval character and influences, without permanent improvements or human habitation, which is protected and managed to preserve its natural condition and which

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable;
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;

- Has at least 5,000 acres or is sufficient size as to make it practicable its preservation and use in an unimpaired condition;
- May also contain ecological, geological, or other feature of scientific educational, scenic, or historic value."

The Wilderness Act of 1964 requires the preservation of wilderness character and recognizes multiple values and public benefits found in these areas. Wilderness provides outstanding opportunities for solitude and for primitive and unconfined recreational experiences. Wilderness is also important for maintenance of species diversity, protection of threatened and endangered species, protection of watershed, scientific research, and various social values. Wilderness is part of the national forest multiple use management mission.

3.13.2 Legal and administrative framework

Law and executive orders

Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136): This act provides the statutory definition of wilderness and management requirements for these congressionally designated areas. This act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness.

National Forest Management Act of 1976, as amended (16 U.S.C. 1600): Provides that management direction for wilderness be incorporated into Forest Plans and sets minimum standards for the content of the Plans.

Code of Federal Regulations (CFR)

- **36 CFR 293:** Wilderness–Primitive Areas
- **36 CFR 261.18:** Prohibitions in National Forest Wilderness.

Other policy

- Bob Marshall Wilderness Complex Fish and Wildlife Monitoring Framework
- Bob Marshall, Great Bear, Scapegoat Wildernesses Recreation Management Direction.

3.13.3 Key indicator

There were no significant issues related directly to designated wilderness resources identified during scoping comment period. There is one indicator for designated wilderness.
Indicator: Protection of wilderness character.

3.13.4 Methodology and analysis process

Information sources

Information sources include the Flathead Forest GIS and the National Visitor Use Monitoring program. Please note, acreages used in the analysis which is generated by geographical information system, differ from official acreages found http://www.fs.fed.us/land/staff/lar-index.shtml

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years)

3.13.5 Affected environment (existing condition)

Wilderness areas provide a wide variety of user opportunities for exploration, solitude, natural, risk, challenge, and primitive and unconfined recreation. Designated wilderness represents the highest concentration of quiet places on the Flathead National Forest where sights and sounds of human presence are relatively unnoticeable. Primary recreational activities within the wilderness are hiking, horseback riding, hunting, fishing, floating, and rafting. Many visitors use the services of an outfitter and guide in wilderness.

The existing wilderness areas should managed in order to preserve the areas' wilderness character. Five qualities help describe wilderness character:

- **Untrammeled**. Wilderness is essentially unhindered and free from modern human control or manipulation.
- **Naturalness.** Wilderness ecological systems are substantially free from the effects of modern civilization.
- **Undeveloped.** Wilderness is essentially without permanent improvements or modern human occupation.
- **Outstanding opportunities for solitude or a primitive and unconfined type of recreation**. Wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge.
- **Other Features of Value**. Wilderness may contain ecological, geological, or other features of scientific educational, scenic, or historical value.

The National Visitor Use Monitoring program (2010) monitors visitor use every 5 years on the forest. The national visitor use monitoring use levels for 2010 in designated wilderness on the Flathead National Forest was 58,000 (The national visitor use monitoring does not separate out the use within the 3 designated wilderness areas). This is about 15 percent of the total visitation in 2010 for the Flathead National Forest.

On the Forest, designated wilderness comprises 45 percent of the forest for a total of 1,075,559[1] acres (official acres). There are three designated wilderness areas within the administrative boundary of the Forest. These wilderness areas are the Bob Marshall, Great Bear, and Mission Mountains, refer to figure 1-01.

The Bob Marshall Wilderness Complex includes the Bob Marshall, Great Bear and Scapegoat Wilderness areas and makes up an area of more than 1.5 million acres. The Bob Marshall Wilderness Complex is jointly managed by five ranger districts on four national forests.

[1] Official acres are from http://www.fs.fed.us/land/staff/lar-index.shtml

Bob Marshall Wilderness

The Bob Marshall Wilderness was named for Bob Marshall, the early wilderness advocate, explorer and conservationist who promoted the development of wilderness management. The Bob Marshall Wilderness was designated in 1964 and is 1,063,703 acres (official acres), the largest wilderness in the Bob Marshall Wilderness Complex, with 712,351 acres on the Flathead National Forest. The South Fork of the Flathead River, a wild and scenic river, is included in this wilderness area. Management of the area is guided by the Bob Marshall, Great Bear, Scapegoat Wildernesses Recreation Management Direction that was approved in 1987.

Great Bear Wilderness

The Great Bear Wilderness is 286,990 acres (official acres) and was congressionally designated in 1978. The Great Bear Wilderness is located on the western side of the Continental Divide entirely within the Flathead National Forest (Hungry Horse and Spotted Bear Ranger Districts). The Middle Fork Flathead River, a wild and scenic river, is within this wilderness for about 50 miles. Schafer Meadows Airstrip is the only open airstrip within the Bob Marshall Wilderness Complex and provides a primary access point for the Schafer area as well as the Middle Fork of the Flathead River. This wilderness is also part of the Bob Marshall Wilderness Complex. Management of the area is guided by the Bob Marshall, Great Bear, Scapegoat Wildernesses Recreation Management Direction that was approved in 1987.

Mission Mountains Wilderness

The Mission Mountains Wilderness is 76,218 acres (official acres) and made up of high peaks, small active glaciers, alpine lakes, meadows, vertical cliff faces, and talus slopes. The region was set aside as the Mission Mountains Primitive Area in 1931 and designated in 1975. The Mission Mountains Wilderness shares its entire western and southern boundaries with the Flathead Indian Reservation; a portion of that is adjacent to the Mission Mountains Tribal Wilderness. Management of the area is guided by the Mission Mountains Wilderness Management Plan approved in 1978.

3.13.6 Environmental consequences

Human use of designated wilderness is largely governed by the terms of the Wilderness Act of 1964. Project specific proposals within designated wilderness are also evaluated through forest plan direction and a minimum requirement analysis to evaluate how the proposal may affect wilderness values. Commercial uses of wilderness are controlled by special use permits and the operation plans that are required under the special use permit.

Because direction for wilderness management is detailed in law, regulation, agency policy and specific management plans, management in the revision alternatives would not differ.

Alternatives A, B, C and D

There is no change in the amount of designated wilderness in any alternative. A primitive experience would be maintained for all three wilderness areas in all alternatives. Natural ecological processes and disturbance are the primary forces affecting the composition, structure and patterns of vegetation. All alternatives would continue to be managed to protect and maintain their wilderness characteristics.

All alternatives carry forward the need for wilderness patrols, wilderness rehabilitation of any impacted sites, wilderness education and wilderness-specific management plans. These activities are common to all alternatives.

Wilderness character would be protected and maintained with all alternatives.

Consequences to designated wilderness from forest plan components associated with other relevant resource programs

Effects from fire and fuels management

Natural, unplanned ignitions would continue the long-term ecological processes in these areas. There could be a temporary loss of vegetation, reduction in water quality due to sedimentation, and air pollution; however, these effects are part of the natural ecological processes.

Effects from vegetative management

These lands are withdrawn from timber production and therefore are not suitable for timber production. They are also not suitable for timber harvest and timber harvest would not occur. There would be no effect to designated wilderness from timber harvest.

Effects from recreation and access

The Bob Marshall Wilderness, Great Bear Wilderness and Mission Mountains Wilderness may be affected by management of adjacent lands such as sights or sounds from vegetation treatments, motorized use or private development.

Effects from mineral management

The Bob Marshall, Great Bear and Mission Mountains Wilderness Areas have been withdrawn from mineral entry and are not available for new leases or claims. Surface and mineral estates within the wilderness are entirely federal.

Cumulative effects

Generally, wilderness areas are in a more natural vegetation condition (i.e., composition, structure) than non-wilderness areas. As large tracts of land relatively free of human-caused disturbance, where natural ecological processes and disturbances are the primary forces, they contribute to maintaining biological diversity while minimizing effects of human development on habitat connectivity. These wilderness areas have played a role in maintaining strongholds of a number of threatened, endangered, and sensitive species such as grizzly bear, lynx and bull trout. Designated wilderness areas on the Flathead National Forest provide outstanding opportunities to experience solitude and/or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge. They provide undeveloped areas without permanent improvements or modern human occupation and areas that are essentially unhindered and free from modern human control or manipulation.

Population growth and development increases the need for public open space. Growth in Flathead, Lake, Missoula and Lincoln counties is likely to increase recreation use of the Forest, which may include an increase in wilderness use. Increased recreation use may impact the wilderness character, particularly the opportunity for solitude and natural quality. Examples of potential impacts include increased opportunity for crowding in high use areas, soil compaction or erosion and threats to native plant species from the spread of noxious weeds from sources outside the wilderness. The effects of urbanization and population growth on wilderness use and resource conditions are likely to be gradual and extend well beyond the planning period.

Currently the Flathead National Forest contributes approximately 30 percent of designated wilderness within Montana, and 10 percent of the National Wilderness Preservation System.

3.14 Recommended Wilderness

3.14.1 Introduction

The wilderness recommendation process occurs in four primary steps: inventory, evaluation, analysis, and recommendation. All plan revisions must complete this process before the Responsible Official determines whether to recommend lands within the plan area to Congress for wilderness designation.

The demand for wilderness goes beyond recreation opportunities. 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) (Rosenberger and 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 finding that roughly 70 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 provides outstanding opportunities for solitude and for primitive and unconfined recreational experiences. Wilderness is also important for maintenance of species diversity, protection of threatened and endangered species, protection of watershed, scientific research, and various social values. Wilderness is part of the national forest multiple use management mission.

3.14.2 Legal and administrative framework

36 CFR Part 219 sec. 219.7 requires the following during revision: Identify and evaluate lands that may be suitable for inclusion in the National Wilderness Preservation System and determine whether to recommend any such lands for wilderness designation. Forest Service Handbook

1909.12 Chapter 70 Wilderness Recommendation contains the framework for the wilderness recommendation process.

3.14.3 Key indicators

These indicators were developed in response to comments and to show how elements are affected by recommended wilderness MA delineation

- Acres of recommended wilderness
- Acres of inventoried roadless area within recommended wilderness
- Acres of motorized over-snow vehicle areas in recommended wilderness
- Miles of motorized over-snow vehicle use in recommended wilderness
- Miles of wheeled motorized use in recommended wilderness

- Miles of trails that allow mechanized transport in recommended wilderness
- Acres of underrepresented ecological groups of the National Wilderness Preservation System in recommended wilderness.

3.14.4 Methodology and analysis process

The directives contain the framework for the wilderness recommendation process. The Flathead National Forest developed the wilderness inventory areas based on the process in 1909.12 chapter 70 section 71. The inventory process is documented here.

The wilderness inventory area was separated into 25 named areas (643,055 acres). All wilderness inventory areas went through a wilderness evaluation which is documented through a wilderness evaluation worksheet for each area found here, and found in appendix F of the Proposed Action—Revised Forest Plan (March 2015) accessible at www.fs.usda.gov/goto/flathead/fpr.

For each alternative, the following indicators were used to evaluate the effects of the wilderness recommendations, as well as the effects to wilderness characteristics as a result of allowing or not allowing mechanized transport and motorized uses to continue:

- Changes in wheeled motorized opportunities compared with the existing condition,
- Changes in motorized over-snow vehicle opportunities compared with the existing condition and
- Changes in trail miles[2] that allow mechanized transport compared with the existing condition.
- Change in the primitive recreation opportunity spectrum settings.

The amount of underrepresented ecological groups that the recommended wilderness areas would add to the National Wilderness Preservation System if these areas were designated and made part of the National Wilderness Preservation System was shown by alternative.

To determine if any recommended wilderness areas contain ecological systems that are not currently represented or minimally represented within the wilderness system or system of research natural areas the Forest analyzed the U.S. Geological Survey Gap Analysis Program national land cover dataset version 2 (USGS 2011). This dataset provides detailed (30 m resolution) information on vegetation and land use patterns of the United States using consistent satellite base data and classification systems. The ecological system level data are cross-walked to the six highest levels of the National Vegetation Classification System (NVCS 2008).

The ecosystem representation at the 6th level (the finest scale at which consistent, spatially-explicit land-cover data are available) of the National Vegetation Classification System, which is considered the group or ecological system, was analyzed.

The U.S. Geological Survey Gap Analysis Program land cover dataset was clipped to the Flathead National Forest boundary in a geographic information system and acreages were calculated for the ecological systems occurring in the different recommended wilderness areas. These values were then analyzed against the acreages of the ecological systems occurring in the Forest. Finally the

[2] Because mechanized transports such as mountain bikes or game carts generally stay on trails, the indicator looks at miles of trails that allowed this use and not acres open to mechanized transport.

output was amended with the national information provided by the Aldo Leopold Wilderness Research Institute, including the total acreage of each ecological system within the National Wilderness Preservation System, along with the proportional percentage of each ecological system found on federal lands is represented in wilderness. This was a part of a national assessment that was conducted (Dietz et al. 2015).

From the calculations above, a listing of 47 ecological groups within the Flathead National Forest was reviewed and those ecological groups having greater or equal to 20 percent of that ecological type represented in the National Wilderness Preservation System compared to all NFS land acres in the lower 48 states were dropped (15). Out of the remaining 32 ecological groups, some groups such as cultivated hay/pasture, harvested, or water type were dropped. Those remaining 22 ecological groups were further reduced if they were less than 4 acres or a group that did not occur on the Flathead National Forest. The end result was that 14 ecological groups were determined to be underrepresented within the recommended wilderness areas on the Flathead National Forest.

Appendix 4 displays each recommended wilderness area and how it responds to required criteria set forth in handbook direction 1909.12 chapter 70, section 73. In addition, appendix 4 displays a summary of each wilderness inventory area and which MA it was allocated to by alternatives and the rationale for the allocation.

The following terms are used in the analysis: ecological and social characteristics and wilderness characteristics. The ecological and social characteristics of recommended wilderness areas that provide the basis for suitability for inclusion into the National Wilderness Preservation System are identified for each recommended wilderness area and can be found in appendix 4.

Wilderness characteristics are *natural quality, undeveloped, unconfined or primitive recreation or solitude and unique or other features*. Oftentimes, the ecological characteristics are discussed in terms of *natural quality* and *undeveloped* and can be represented by landscapes where evidence of human disturbance is not readily apparent or the intactness of an ecosystem. Social characteristics can be discussed in terms of *solitude* or *unconfined or primitive recreation* and often represented by remote, quite landscapes where recreation activities such as hiking, climbing, fishing and hunting are predominant.

Information sources

Geospatial analysis was used for the indicators. See above for the datasets associated with the underrepresented ecological groups.

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years).

3.14.5 Affected environment (existing condition)

The 1986 Forest Plan recommended about 98,400 acres for wilderness. The five areas are: Alcove, Jewel Basin, Limestone, Slippery Bill and the Swan Front.

These areas overlaid MAs that range from unroaded lands to roaded and suitable for timber management. The 1986 Forest Plan standard for recommended wilderness states that the management standards for these areas will be consistent with the standards of the non-wilderness MA designation, except that no action can occur which will reduce the areas' wilderness attributes

until Congress has made a decision on wilderness classification or otherwise specified how these areas will be managed.

The Swan Front, Alcove and Limestone recommended wilderness areas are currently closed to mechanized transport and motorized use (wheeled and motorized over-snow vehicles) because of a 1986 Forest Plan standard that requires recommended wilderness areas adjacent to designated wilderness be managed like designated wilderness.

3.14.6 Environmental consequences

Alternative A

As the no action alternative, this alternative does not propose any changes to what was recommended as wilderness in the 1986 Forest Plan (98,446 acres). Table 32 lists and names the five areas recommended as wilderness in the 1986 Forest Plan and table 33 lists the indicators that were used. National direction requires that areas recommended for wilderness are not available for any use or activity that may reduce the wilderness potential of an area. Recommended wilderness areas such as Alcove, Limestone and the Swan Front have closure orders that prohibit mechanized transport (e.g. mountain bicycle or game cart) and motorized use (wheeled and motorized over-snow vehicles). The Slippery Bill Recommended Wilderness Area is open to mechanized transport which could affect the undeveloped and primitive recreation wilderness characteristic; the existing mechanized transport use would not reduce the wilderness potential of this area. This alternative represents approximately 21 percent of the inventoried roadless areas on the forest.

Table 32. Recommended Wilderness areas and acres in alternative A

Recommended Wilderness Area Name	Acres
Alcove	9,998
Jewel Basin	32,972
Limestone Cave	5,076
Slippery Bill	5,585
Swan Front	44,815

Table 33. Indicators for alternative A

Indicators	Unit of measure
Acres of recommended wilderness	98,446 acres
Acres of inventoried roadless areas within recommended wilderness	95,337 acres
Acres of suitable motorized over-snow vehicle areas in recommended wilderness	12,600 acres
Miles of motorized over-snow vehicle use routes in recommended wilderness	none
Miles of wheeled motorized use in recommended wilderness	2 miles
Miles of trails that allow mechanized transport in recommended wilderness	26 miles
Acres of underrepresented ecological groups of the National Wilderness Preservation System in recommended wilderness	23,685 acres

The total amount of recommended wilderness when combined with existing designated wilderness (1,075,376 [3] acres) would bring the total acreage to about 1,173,822 acres or about 49 percent of the Flathead National Forest that is in designated or recommended wilderness. These acres would provide a recreation opportunity spectrum primitive setting across the forest. These acres would provide a primitive setting on the 48 percent of the forest, where wheeled motorized use, motorized over-snow vehicle use and mechanized transport (e.g. mountain bicycles) would decrease and recreational opportunities such as hiking, horseback riding and skiing would increase across the forest in a primitive setting. The primitive setting is characterized by large, remote, wild, and predominately unmodified landscapes with no motorized activity and little probability of seeing other people. Primitive settings are managed for quiet solitude away from roads, people, and development. There are few, if any facilities or developments. This alternative provides opportunity for a primitive recreation opportunity spectrum setting through recommending 98,446 acres for wilderness designation. Alternative A has more primitive setting than alternative D and less than alternatives B and C, therefore it would provide the third highest amount of primitive setting on the forest.

This alternative includes 23,685 acres of underrepresented ecological groups which is higher than alternative D, and lower than alternatives B and C. This acreage is the amount this alternative would add of underrepresented ecological groups to the National Wilderness Preservation System if these areas were designated and made part of the National Wilderness Preservation System was shown by alternative.

The Jewel Basin Hiking Area (15,283 acres) would continue to be within the Jewel Basin Recommended Wilderness Area (32,972 acres). The Jewel Basin Hiking Area would still retain prohibitions on stock and pack animals, mechanized transport and motorized uses. Outside of the Jewel Basin Hiking Area, but within the Jewel Basin Recommended Area (17,689), there is an area which allows mechanized transport on 26 miles trails, and wheeled motorized use on 2 miles of trail and these uses would continue.

Alternative B

Table 34 lists and names the nine areas recommended for wilderness in this alternative for a total of about 187,741 acres. Table 35 lists the indicators that were used. This represents approximately 36% of the inventoried roadless areas on the forest. This alternative allows for existing mechanized transport (e.g., mountain bikes) or motorized uses to continue as long as those uses do not prevent the protection and maintenance of the social and ecological characteristics that provide the basis for wilderness designation (*see* plan component MA1b-SUIT). However, if monitoring shows use is above current levels in these areas or if that use is not maintaining or protecting the ecological or social characteristics that made the area suitable for inclusion into the National Wilderness Preservation System, that specific motorized use or mechanized transport would then not be suitable in those area. New mechanized transport or motorized uses that are not occurring now are not suitable. Existing mechanized transport and motorized use have been occurring in these areas recommended for wilderness for many years, even decades. Yet the effects of the existing uses, at current levels, have not prevented these areas from being considered for wilderness; these areas still retain sufficient social and ecological characteristics that would allow them to be recommend them for wilderness.

[3] These acres are from GIS acres and differ from official wilderness acres of 1,075,559 acres

Table 34. Recommended wilderness areas and acres in alternative B

Recommended Wilderness Area Name	Acres
Alcove	12,627
Elk Creek	2,032
Fatty Creek	973
Java-Bear Creek	1,824
Jewel Basin	21,996
Limestone –Dean Ridge	15,026
Slippery Bill	7,225
Swan Front	45,330
Tuchuck-Whale	80,708

Table 35. Indicators for Alternative B

Indicators	Unit of measure
Acres of recommended wilderness	187,741 acres
Acres of inventoried roadless area within recommended wilderness	173,401 acres
Acres of suitable motorized over-snow vehicle areas in recommended wilderness	973acres
Miles of motorized over-snow vehicle routes in recommended wilderness	<1 mile
Miles of wheeled motorized use in recommended wilderness	none
Miles of trails that allow mechanized transport in recommended wilderness	111 miles
Acres of underrepresented ecological groups of the National Wilderness Preservation System in recommended wilderness	31,867 acres

Fatty Creek Recommended Wilderness Area has about 973 acres that is suitable for motorized over-snow vehicle use.

In alternative B, there are 111 miles of trails that would continue to allow mechanized transport. The mechanized transport is mostly concentrated in the Tuchuck-Whale Recommended Wilderness Area with 87 miles of system trails open to mechanized transport. The remaining trails are scattered throughout the recommended wilderness areas with the largest mileage in the Limestone Recommended Wilderness Area with 8 miles of trail, the Swan Front Recommended Wilderness Area at 4 miles, the Slippery Bill Recommended Wilderness Area at 4 miles, and the Jewel Basin Recommended Wilderness Area at 6 miles; the remaining two areas have short segments generally 1 mile or less.

Mechanized transport (e.g. bicycles, carts) and motorized uses may affect the undeveloped nature (ecological characteristic) and primitive recreation (social characteristic) where recommended wilderness is essentially without permanent improvements or modern human occupation and social characteristics of *primitive recreation*, but these effects will be monitored (refer to Appendix C, Monitoring Plan) to ensure that such use does not degrade the social and ecological characteristics that provide the basis for wilderness recommendation. In addition, motorized uses such as over-snow vehicle use, wheeled motorized use or chainsaws can impact the solitude and primitive recreation (social characteristics) but these effects will be monitored.

Not every person traveling through these recommended wilderness areas will meet a mountain biker or snowmobiler. The areas that would allow mechanized transport or motorized use see relatively low amounts of use for these activities; the majority of time, these uses would not be encountered.

Any type of trail, whether for hikers or horseback riders can affect the undeveloped characteristics (ecological characteristics) as a trail is considered a development. Solitude can be affected by noise but also can be affected by encountering other people who are hiking or horseback riding. Social and ecological characteristics that provide the basis for wilderness designation have been identified for all recommended wilderness areas for alternatives B and C; refer to appendix 4.

There are 6 miles of existing system roads within the recommended wilderness areas in this alternative. In the Swan Front Recommended Wilderness Area, there are 1 miles of existing system roads that are closed to public access and in the Tuchuck-Whale Recommended Wilderness Area, there are 5.0 miles of existing system roads. These roads would be decommissioned. These roads are currently closed to motorized use so there would be no change in existing access. Over time, these roads would revegetate and become more natural in appearance. The total amount of recommended wilderness when combined with existing designated wilderness (1,075,376[4] acres) would bring the total acreage to about 1,263,117 acres or approximately 53 percent of the Flathead National Forest that is in designated or recommended wilderness. These acres would provide a primitive recreation setting on the majority of the forest.

These acres would provide a primitive setting on the majority of the forest, where wheeled motorized use, motorized over-snow vehicle use and mechanized transport (e.g. mountain bicycles) would decrease and recreational opportunities such as hiking, horseback riding and skiing would increase across the forest in a primitive setting.

The primitive setting is characterized by large, remote, wild, and predominately unmodified landscapes with no motorized activity and little probability of seeing other people. Primitive settings are managed for quiet solitude away from roads, people, and development. There are few, if any facilities or developments. This alternative provides opportunity for a primitive recreation opportunity spectrum setting through recommending 187,741 acres for wilderness designation. This alternative provides the most primitive setting on the forest than all the other alternatives. This alternative provides more primitive setting that alternatives A and D but less than alternative C, therefore it would provide the second highest amount of primitive setting on the forest.

This alternative includes 31,867 acres of underrepresented ecological groups which is higher than alternatives A and D, and lower than alternative C. This acreage is the amount this alternative would add of underrepresented ecological groups to the National Wilderness Preservation System if these areas were designated and made part of the National Wilderness Preservation System was shown by alternative.

This alternative would require monitoring of the social and ecological characteristics that provide the basis for wilderness recommendations to ensure that the levels of use do not prevent the protection and maintenance of the identified social and ecological characteristics for each recommended wilderness area (refer to appendix A, table A-14). Monitoring requirements are tied to recommended wilderness areas where existing mechanized transport or motorized over-snow vehicle use would be allowed to continue such as Fatty Creek Recommended Wilderness Area (motorized over-snow vehicle use), Limestone –Dean Ridge Recommended Wilderness Area (mechanized transport) and Tuchuck-Whale Recommended Wilderness Area (mechanized transport); see to appendix 4.

[4] These acres are from GIS acres and differ from official wilderness acres of 1,075,559 acres

The Jewel Basin Hiking Area (15,300 acres) would become part of the Jewel Basin Recommended Wilderness Area (21,996 acres). The Jewel Basin Hiking Area within the recommended wilderness area would still retain prohibitions on stock and pack animals, mechanized transport and motorized uses. The recommended wilderness area is smaller than what was recommended for wilderness in the 1986 plan by about 11,000 acres. The portion of the Jewel Basin Recommended Wilderness Area (6,700 acres) outside of the Jewel Basin Hiking Area allows mechanized transport on 23 miles of trails, 2 miles of wheeled motorized trails, and motorized over-snow vehicle use on 6 acres.

Alternative C

Table 30 lists the 17 areas recommended for wilderness in this alternative for a total of 506,919 acres, and table 37 lists the indicators that were used. This area represents approximately 97 percent of the inventoried roadless areas on the forest.

Table 36. Recommended wilderness areas and acres in alternative C

Recommended Wilderness Area Name	Acres
Alcove – Bunker	63,962
Canyon	7,939
Coal	45,257
Cold Jim	317
Elk Creek	2,964
Essex	13,788
Fatty –Woodard Creek	2,133
Hungry Horse East	33,503
Java-Bear Creek	3,725
Jewel Basin –Swan Crest	135,759
LeBeau	5,950
Limestone –Dean Ridge	26,294
Piper Creek	642
Sky West	5,193
Slippery Bill –Puzzle	20,703
Swan Front	48,151
Tuchuck-Whale	90,638

Table 37. Indicators for recommended wilderness for Alternative C

Indicators	Unit of measure
Acres of recommended wilderness	506,919 acres
Acres of inventoried roadless areas within recommended wilderness	467,461 acres
Acres of suitable motorized over-snow vehicle areas in recommended wilderness	169,248 acres
Miles of motorized over-snow vehicle routes in recommended wilderness	4 miles
Miles of wheeled motorized use in recommended wilderness	75 miles
Miles of trails that allow mechanized transport in recommended wilderness	417 miles
Acres of underrepresented ecological groups of the National Wilderness Preservation System in recommended wilderness	130,007 acres

This alternative includes the plan component (MA1b-SUIT): Mechanized transport, and motorized travel and uses are not suitable in recommended wilderness.

Therefore, the following changes could occur:

- Mechanized transport on system trails within recommended wilderness areas could be decreased by 417 miles to 0 miles after site-specific analysis was completed.
- Wheeled motorized use on designated routes could be decreased from 75 miles to 0 miles within in recommended wilderness after site-specific analysis was completed.
- Motorized over-snow vehicle use on designated routes within recommended wilderness areas could decrease from 4 miles to 0 miles after site-specific analysis is completed.
- Acres suitable for motorized over-snow vehicle use areas could decrease 169,248 acres to 0 acres on the Forest after site-specific analysis is completed.

This alternative changes the most wheeled motorized use, mechanical transport opportunities and motorized over-snow vehicle use opportunities on the Forest. Forest wide, wheeled motorized use would decrease from 226 miles to 151 miles of designated trails; mechanized transport on system trails would decrease from 806 miles to 389 miles; motorized over-snow vehicle use on designated routes would decrease from 1,964 to 1,959 miles, and motorized over snow vehicle use on designated areas would decrease from to 457,133 to 287,855 acres. Displacement of motorized (wheeled and motorized over-snow vehicle) and mechanized transport on the Forest could occur when and if a site-specific decision is completed to prohibit these uses in recommended wilderness. Should these closures occur, use may become concentrated in areas that are suitable for motorized wheeled and motorized over-snow vehicle causing some users to have negative experiences and/or go elsewhere to an off-forest location or to other lands open to motorized use and mechanized transport.

There are 48 miles of existing system roads within the recommended wilderness areas in this alternative; these roads would be decommissioned. These roads are currently closed to motorized use so there would be no change in existing access. Over time, these roads would revegetate and become more natural in appearance.

The total amount of recommended wilderness when combined with existing designated wilderness (1,075,376[5] acres) would bring the total acreage to about 1,582,295 acres or approximately 66 percent of the Flathead National Forest that is in designated or recommended wilderness. These acres would provide a primitive setting on the majority of the forest, where wheeled motorized use, motorized over-snow vehicle use and mechanized transport (e.g. mountain bicycles) would decrease and recreational opportunities such as hiking, horseback riding and skiing would increase across the forest in a primitive setting.

The primitive setting is characterized by large, remote, wild, and predominately unmodified landscapes with no motorized activity and little probability of seeing other people. Primitive settings are managed for quiet solitude away from roads, people, and development. There are few, if any facilities or developments. This alternative provides opportunity for a primitive setting through recommending 506,919 acres for wilderness designation. This alternative provides the most primitive setting on the forest than all the other alternatives.

[5] These acres are from GIS acres and differ from official wilderness acres of 1,075,559 acres

This alternative includes 130,007 acres of underrepresented ecological groups which is the highest of all alternatives. This acreage is the amount this alternative would add of underrepresented ecological groups to the National Wilderness Preservation System if these areas were designated and made part of the National Wilderness Preservation System was shown by alternative.

The Jewel Basin Hiking Area (15,300 acres) would become part of the Jewel Basin Recommended Wilderness Area (135,759 acres). The Jewel Basin Hiking Area within the recommended wilderness area would still retain prohibitions on stock and pack animals, mechanized transport and motorized uses. The recommended wilderness area is larger than what was recommended for wilderness in the 1986 plan by 102,787 acres.

Alternative D

There are no areas recommended for wilderness in this alternative; recommended wilderness areas allocated in the 1986 Forest Plan are not within this alternative. The following is MA allocations for this alternative for the 5 areas that were recommended wilderness in the 1986 plan.

- Alcove Recommended Wilderness Area is 100 percent 5a (backcountry non-motorized).
- Jewel Basin Recommended Wilderness Area is 40 percent 3b (special MA for Jewel Basin Hiking Area), 30 percent 5c (backcountry winter motorized), 17 percent 5a (backcountry non-motorized), 6 percent (2b eligible wild and scenic river), and 5 percent 5b (backcountry xx).
- Limestone Cave Recommended Wilderness Area is 74 percent 5a (backcountry non-motorized), and 26 percent 2b (eligible wild and scenic river).
- Slippery Bill Recommended Wilderness Area is 95 percent 5a (backcountry non-motorized), 4 percent 6a (general forest low intensity) and 1 percent 5c (backcountry, winter motorized).
- Swan Front Recommended Wilderness Area is 93 percent 5a (backcountry non-motorized) and 6 percent 2b (eligible wild and scenic river).

Wilderness characteristics within inventoried roadless areas would be generally maintained by the requirements of the Roadless Area Conservation Rule which prohibits road building and limit timber harvest. Refer to the Inventoried Roadless Area section for additional information. The Flathead National Forest would continue to provide primitive experience on the existing designated wilderness of 1.4 million acres (45 percent of the Forest). A primitive setting is provided on 45 percent of the forest in this alternative.

There would be no changes to miles of mechanized trails, miles of wheeled motorized trails, to miles or acres of motorized over-snow use miles or acres or change in hiking and stock trail miles.

Table 38. Indicators for recommended wilderness for alternative D

Indicators	Unit of measure
Acres of recommended wilderness	0 acres
Acres of inventoried roadless areas within recommended wilderness	0 acres
Acres of suitable motorized over-snow vehicle areas in recommended wilderness	0 acres
Miles of motorized over-snow vehicle routes in recommended wilderness	0 miles
Miles of trails that allow mechanized transport in recommended wilderness	0 miles

Indicators	Unit of measure
Acres of underrepresented ecological groups of the National Wilderness Preservation System in recommended wilderness	0 acres

Approximately 45 percent (1,072,040 [6] acres) of the Flathead National Forest is in designated wilderness. These acres would provide a primitive recreation setting on the forest, where wheeled motorized use, motorized over-snow vehicle use and mechanical transport (e.g. mountain bicycles) would not be suitable. However, because this alternative recommends no additional areas for wilderness, opportunities for solitude and remoteness would decrease across the forest in a primitive setting that offers remote and predominately unmodified landscapes. Therefore this alternative provides the least amount of primitive setting than all the alternatives.

This alternative includes 0 acres of underrepresented ecological groups therefore this alternative provides the least amount of additions of underrepresented ecological groups than all the other alternatives. This acreage is the amount this alternative would add of underrepresented ecological groups to the National Wilderness Preservation System if these areas were designated and made part of the National Wilderness Preservation System was shown by alternative.

The Jewel Basin Hiking Area (15,283 acres) would continue retain prohibitions on stock and pack animals, mechanized transport and motorized uses.

Consequences to recommended wilderness areas from Forest Plan components associated with other relevant resource programs

Effects from MA allocations

Management area allocation vary between alternative as well as plan components allowing existing motorized uses and mechanized transport (alternatives A and B) or having recommended wilderness not suitable for motorized use or mechanized transport in recommended wilderness (alternative C). Wilderness characteristics, and the ecological and social characteristics that provide the suitability for inclusion into the National Wilderness Preservation System would be protected and maintained with alternatives A, B and C, with additional monitoring requirements in alternative B to assure that any existing motorized use or mechanized transport was not affecting the wilderness characteristics and the ecological and social characteristics that provide the suitability for inclusion into the National Wilderness Preservation System of the recommended wilderness areas.

Effects from fire and fuels management

Effective fire suppression, insect and disease infestations, and native vegetation and fuel types on the Flathead National Forest create fuel conditions that could support moderate to high severity wildfires in some areas. Lightening caused fires may be managed to meet resource benefits to trend vegetation towards desired conditions. Likewise, prescribed fire for restoration purposes may be used to trend vegetation towards the desired conditions.

The use of natural, unplanned ignitions would be more likely in alternatives B and C, which emphasizes the use of natural disturbances and has the highest and the second highest acres of recommended wilderness. The use of natural, unplanned ignitions would continue the long-term ecological processes in these areas. There could be a substantial changes in existing forest cover,

[6] These acres are from GIS acres and differ from official wilderness acres of 1,075,559 acres

reduction in water quality due to sedimentation, and air pollution; however, these effects are part of the natural ecological processes. The opportunity to use natural, unplanned ignitions within some of the recommended wilderness would be limited, due to their shape, size and location relative to values at risk, should a wildfire occur. Refer to section 3.5.1 for detailed discussion of this effect, related to restoration activities for whitebark pine. Recommended wilderness is suitable for restoration activities where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintained and protected. Prescribed fire for restoration purposes could affect the natural quality and solitude wilderness characteristics, especially where crews are burning or monitoring burns.

Effects from vegetative management

These lands are not suitable for timber production and timber harvest is not allowed. Most lands within recommended wilderness are within inventoried roadless areas that have high to outstanding wilderness characteristics, primarily due to unroading and timber harvesting not occurring in much of these areas. Therefore, there are very few acres within recommended wilderness where timber production would have been considered suitable. ,. . Refer to Timber section 3.20.8 for more information.

Recommended wilderness areas are characterized by a natural environment where ecological processes such as natural succession, wildfire, avalanches, insects, and disease function with limited amount of human influence. However, recommended wilderness is suitable for restoration activities where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintained and protected. Restoration activities could include restoration of whitebark pine (currently a candidate species under the Endangered Species Act) which could consist of prescribed burning, planting of rust-resistant whitebark pine seedlings or seeding, thinning with an emphasis on hand thinning over mechanical, and protecting phenotypically superior seed producing whitebark pine trees from loss due to fire, bark beetles, or other stressors. Control of invasive plant species by hand pulling and/or herbicide spraying and planting or seeding of native plant species could also occur. Vegetation management options would likely change in the future if recommended wilderness areas are designated as wilderness. Refer to the vegetation section 3.3.11, the plant species section 3.5.1 and the fuels and fire management section 3.8.9 for addition information on these effects to vegetation management.

Effects from recreation and access

As discussed in the effects, the greatest change in the amount suitable motorized, mechanized transport and non-motorized/non-mechanized transport use from existing conditions is with alternative C which has the most amount of area not suitable for wheeled motorized use, motorized over-snow vehicle use and mechanized transport and has the most amount of acres suitable for non-motorized/non-mechanized transport such as hiking and stock use. Alternative D has the least amount of change as there is no recommended wilderness, followed by alternatives A and then B.

New road construction or reconstruction is not suitable in recommended wilderness areas which limits the amount of new access on the Forest. Alternative C would have the most amount of area not suitable for new rods or road reconstruction, followed by alternatives A, B, and D.

Recommended wilderness is not suitable for developed recreation facilities that provide for user comforts such as picnic tables, fire grills, and vault toilets. These areas are generally in the primitive recreation opportunity spectrum setting where challenges and predominately unmodified landscapes

and are managed for quiet solitude away from roads, people, and development. Alternative C would have the most amount of area not suitable recreation facilities that provide for user comforts, followed by alternatives A, B, and D.

Effects from wildlife and fish management

Recommended wilderness areas are characterized by a natural environment where ecological processes such as natural succession, wildfire, avalanches, insects, and disease function with limited amount of human influence. Impacts from visitation do not detract from the natural setting. However, recommended wilderness is suitable for restoration activities where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintained and protected. Restoration activities or management activities for wildlife and fish could include monitoring, relocation of animals, habitat improvements such as use of prescribed fire, removal of non-native fish species and stream improvements.

Management for wildlife and fish may occur in recommended wilderness areas as long wilderness characteristics, and the ecological and social characteristics that provide the suitability for inclusion into the National Wilderness Preservation System would be protected and maintained for alternatives A, B and C.

Refer to the wildlife section 3.7.6 and the fish section for additional information.

Effects from minerals management

Recommended wilderness areas are not withdrawn from mineral entry and are available for new leases or claims as long as the social and ecological characteristics that provide a basis for wilderness designation are maintained and protected. Therefore the effects of mineral management would be the same with all alternatives and the social and ecological characteristics that form the basis of wilderness designation would be protected and maintained.

Cumulative effects

In general, cumulative effects are the past, present and reasonably foreseeable future effects from management activities on the Forest and adjacent lands.

Reasonable and foreseeable future actions on NFS lands include: vegetation management, mining, expansion of ski areas, and reduction of fuels in wildland urban interface. These actions could impact the wilderness characteristics of solitude, depending on how close and pervasive these actions were, although we typically just look to sights and sounds within the recommended wilderness area to determine effects to wilderness characteristics. For example, vegetation management activities such as harvesting adjacent to recommended wilderness area may increase the sights and sounds of logging equipment such as chainsaws and skidders within the recommended wilderness area but because it's outside of the recommended wilderness area, it's not considered to degrade the wilderness characteristic of solitude. However, an expansion of a ski area adjacent to recommended wilderness could increase use levels within the recommended wilderness which may affect solitude as the number of encounters with others could increase within the recommended wilderness area.

Growth in Flathead, Lake, Lincoln and Missoula counties, as well as surrounding areas in Idaho and Washington, is likely to increase recreation use of the Forest including an increase in use within recommended wilderness. The effects of urbanization and population growth on recommended wilderness use and resource conditions are likely to be gradual and extend well beyond the planning

period. Increased recreation use may negatively impact the wilderness characteristics, particularly the opportunity for solitude and natural quality. Examples of potential impacts include increased opportunity for crowding in certain locations, soil compaction or erosion and threats to native plant species from the spread of noxious weeds from sources outside the wilderness.

Currently the Flathead National Forest contributes approximately 30 percent of designated wilderness within Montana, and 10 percent of the National Wilderness Preservation System. Alternative C could potentially add the most amount of acres to the National Wilderness System, followed by alternatives B and A. The alternatives rank D, A, B, and C from the least to most area retaining wilderness characteristics over the next 15 years. In terms of wilderness recommendation, the alternatives rank C, B A, and D from the most to the least area recommended for wilderness.

Three recommended wilderness areas on the Forest (Swan Front, Tuchuck Whale and LeBeau) are adjacent to other forests. The Swan Front Recommended Wilderness Area shares about 2 miles of boundary with the Lolo National Forest which does not have a recommended wilderness adjacent to the Swan Front Recommended Wilderness Area. About 1 mile of the shared boundary is adjacent to a roadless area management allocation for the Lolo National Forest. This specific area (near Ptarmigan Mountain) does not have any system trails within the vicinity and motorized over-snow vehicle use is prohibited in this area. This shared boundary and roadless area allocation is also part of the Forest Jobs and Recreation Act proposed wilderness for the West Clearwater Wilderness Addition. This roadless area on the Lolo National Forest is adjacent to the Bob Marshall Wilderness.

The Tuchuck-Whale Recommended Wilderness Area shares its westerns boundary with the Kootenai National Forest for about 20 miles, along the Whitefish Divide. The Kootenai National Forest does not have any recommended wilderness area adjacent to the shared boundary with this recommended wilderness area; about 5 miles of the boundary is MA 5b which allows motorized use yearlong on designated trails and areas and about 15 miles of the boundary is MA 5a which does not allow motorized use. The Ten Lakes Wilderness Study Area on the Kootenai National Forest is about 3 miles from the Tuchuck-Whale Recommended Wilderness Area.

The LeBeau Recommended Wilderness Area shares its western and portions of its northern boundary for about 6 miles with the Kootenai National Forest which does not have any recommended wilderness areas adjacent to the LeBeau Recommended Wilderness Area. About 1 miles of its northern boundary is adjacent to a research natural area, and 1 mile adjacent to MA 5b which allows motorized use yearlong on designated trails and areas. The western boundary is adjacent to MA 6 which is general forest area and allows motorized use on designated trails and areas.

3.15 Inventoried Roadless Areas

3.15.1 Introduction

Inventoried roadless areas are designated areas under the Roadless Area Conservation Rule (RACR; USDA Forest Service 2001; 36 CFR Part 294). These areas were first inventoried by the Forest Service in 1972, as part of the Roadless Area Review and Evaluation phase I. In 1972, the Forest Service initiated a review of NFS lands roadless areas generally larger than 5,000 acres to determine their suitability for inclusion in the National Wilderness Preservation System. A second review process completed in 1979, known as the Roadless Area Review and Evaluation II, resulted in another nationwide inventory of roadless areas.

3.15.2 Legal and administrative framework

Regulations

2001 Roadless Area Conservation Rule (36 CFR 294 Subpart B): The 2001 Roadless Rule establishes prohibitions on road construction and road reconstruction, and limitations on timber cutting, sale or removal within inventoried roadless areas on NFS lands. The intent of the 2001 Roadless Rule is to provide lasting protection for inventoried roadless areas within the NFS in the context of multiple-use management. Refer to figure B-02 for the inventoried roadless areas on the Flathead National Forest. These areas were identified in the Forest Service Roadless Area Conservation Final Environmental Impact Statement, volume 2 (USDA 2000).

3.15.3 Key indicators

- Percentage of MA 1b (recommended wilderness)
- Percentage in MAs 2a and 2b (designated and eligible wild and scenic rivers)
- Percentage in MA 3b (special areas)
- Percentage in MA 4a (research natural areas)
- Percentage in MA 5a-d (backcountry)
- Percentage in MA 6a (general forest low)
- Summer and winter ROS classes in inventoried roadless areas by alternatives.

3.15.4 Methodology and analysis process

Indicators are presented under each alternative under the affected environment section..

Information sources

Geographic information system

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead National Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years)

3.15.5 Affected environment (existing condition)

There are 478,758 acres of inventoried roadless areas, refer to figure B-02, on the Flathead National Forest. The acreage designated as inventoried roadless areas constitutes 20 percent of lands administered by the Forest. Twenty percent of the recommended wilderness areas from the 1986 Plan are within inventoried roadless area lands on the Forest. Inventoried roadless areas have also been allocated to other MAs other than recommended wilderness. Inventoried roadless areas, although allocated to various MAs, would also be managed under the 2001 Roadless Area Conservation Rule. Table 39 shows the percentage of MA groups within the inventoried roadless area on the forest and includes what was suitable or unsuitable for timber production. The Forest Plan allocated about 75 percent of inventoried roadless areas as unsuitable for timber. About 4,000 acres were harvested in inventoried roadless areas since 1985 which is less than 1 percent of the inventoried roadless area acreage on the forest.

Table 39. Percentage of largest MA groupings within inventoried roadless areas (IRAs) on the Forest

Management area group and description	Percentage within IRAs (percent)
Management Areas 2, 2a, 2b, 2c Unroaded lands, unsuitable for timber management	41
Management Areas 11, 11a Grizzly bear habitat, unsuitable for timber management	28
Management Areas 15, 15a, 15b, 15e Roaded timber lands, suitable for timber management	9
Management Areas 3, 3a Unsuitable for timber management	5
Management Areas 13, 13a, 13d Roaded/unroaded lands, winter range MA-13 suitable for timber management MAs 13a &d unsuitable for timber management	4
Management Areas 16a, 16b, 16c Unroaded timberlands, suitable for timber	3

There has been little road building in the inventoried roadless area; a total of 3 miles in the inventoried roadless areas on the forest and less than 1 mile of road suitable for passenger cars have been constructed since the 1986 Forest Plan (see table 40).

Table 40. Summary of wheeled motorized trails, motorized over-snow vehicle motorized areas, motorized over-snow vehicle in acres and roads within the inventoried roadless areas on the Forest

Total Acres	Wheeled motorized trails	Motorized over-snow vehicle routes	Motorized over-snow vehicle areas	Road suitable for high clearance vehicles	Road suitable for passenger car
478,758	72 miles	4 miles	160,570 acres	3 miles	<1 miles

For summer, semi-primitive non-motorized was the largest recreation opportunity spectrum class (72 percent) in the forest's inventoried roadless area, followed by primitive at 18 percent, roaded natural at 6 percent, and semi-primitive motorized at 5 percent. For winter, semi-primitive non-motorized was the largest recreation opportunity spectrum class (44 percent) in the forest's

inventoried roadless area, followed by semi-primitive motorized at 38 percent, primitive at 17 percent, and roaded natural at 1 percent.

Roadless characteristics:

- High quality or undisturbed soil, water, and air. Source of public drinking water. Diversity of plant and animal communities. Habitat for threatened, endangered, candidate, proposed and sensitive species on large areas.
- Natural appearing landscapes with high or very high scenic integrity.
- Primitive, semi-primitive non-motorized and semi-primitive motorized recreation opportunity classes of dispersed recreation.
- Other locally identified unique characteristics. Traditional cultural properties and scared sites.

3.15.6 Environmental consequences

Alternative A – no action

Table 41 displays that 20 percent of inventoried roadless areas on the Forest are also allocated as recommended wilderness in this alternative. This alternative has the third highest amount of inventoried roadless area allocated to recommended wilderness.

Table 41. Indicators for alternative A

Indicator	Measure
Percentage in MA 1b (recommended wilderness)	20%
Percentage of summer recreation opportunity spectrum classes	semi-primitive non-motorized 72%, semi-primitive motorized 5%, roaded natural 6%, primitive 18%
Percentage of winter recreation opportunity spectrum classes	semi-primitive non-motorized 44%, semi-primitive motorized 38% primitive 17%, roaded natural 1%

MA – management area

Table 41 shows that the largest class of the summer recreation opportunity spectrum within the inventoried roadless areas of the forest is semi-primitive non-motorized (72 percent), followed by primitive (18 percent), then roaded natural (6 percent) and then semi-primitive motorized (5 percent). Semi-primitive non-motorized settings encompass remote, large, natural landscape where that offer opportunities for exploration, challenge, solitude and self-reliance. This alternative provides a summer non-motorized setting on 90 percent and a summer motorized setting on 10 percent of the inventoried roadless areas of the Forest. This alternative would provide a higher amount of summer non-motorized setting than to alternative D and lower amount of summer non-motorized setting than alternatives B and C within the inventoried roadless areas on the forest. Conversely, this alternative provides a higher amount of summer motorized setting than alternatives B and C and a lower amount of summer motorized setting than alternative C within inventoried roadless areas on the Forest.

Table 41 shows that the largest class of winter recreation opportunity spectrum class is semi-primitive non-motorized (44 percent), followed by semi-primitive motorized (38 percent), and then

primitive (17 percent). This alternative provides 61 percent winter non-motorized setting and 39 percent of winter motorized setting within inventoried roadless areas on the Forest. This alternative would provide the lowest amount of winter non-motorized setting within the inventoried roadless areas on the forest compared to all alternatives. Conversely, this alternative would provide the highest amount of winter motorized setting within inventoried roadless areas on the forest compared to all alternatives.

Alternatives B

Table 42 displays that management area 1b (recommended wilderness) is unsuitable for timber production nor is timber harvest allowed. Although some restoration activity (e.g. whitebark pine planting, prescribed burning, protecting superior whitebark pine trees) is suitable where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintain and protect.

Table 42. Indicators for alternative B

Indicator	Measure
Percentage in MA 1b (recommended wilderness)	35%
Percentage in MAs 2a and 2b (designated and eligible wild and scenic rivers)	3%
Percentage in MA 3b (special areas)	0 acres
Percentage in MA 4a (research natural areas)	2%
Percentage in MA 5a-d (backcountry)	57%
Percentage in MA 6a (general forest low)	3%
Percentage of summer recreation opportunity spectrum classes	semi-primitive non-motorized 55%; primitive 37%; semi-primitive motorized 6%, roaded natural 3%;
Percentage of winter recreation opportunity spectrum classes	primitive 36%; semi-primitive non-motorized 32%; semi-primitive motorized 30%; roaded natural 1%;

MAs 2a, 2b, 3b, 4a, 5a, 5b, 5c, 5d and 6a are unsuitable for timber production although low levels of timber harvest for multiple-use purposes, for salvage logging and to achieve desired vegetation conditions could occur. About 35 percent of inventoried roadless areas were allocated to recommended wilderness and a large percentage (57 percent) to backcountry MAs (5a-d) with 3 percent to MA 6a. About 3 percent was allocated to designated or eligible rivers. This alternative would allocate 35 percent of the inventoried roadless areas on the Forest as recommended wilderness as compared to alternative A which recommended 20 percent of the inventoried roadless areas as recommended wilderness. This alternative has the second highest amount of inventoried roadless areas allocated to recommended wilderness.

Table 42 shows that the largest class of the summer desired recreation opportunity spectrum is semi-primitive non-motorized (55 percent), followed by primitive (37 percent) and semi-primitive motorized (6 percent). This alternative provides a summer non-motorized setting on 92 percent and summer motorized setting on 9 percent of the inventoried roadless areas on the Forest. This alternative would provide a higher amount of summer non-motorized setting within the inventoried

roadless areas on the Forest as compared to alternatives A and D and lower amount than alternative C. Conversely, this alternative provides a higher summer motorized setting within inventoried roadless areas than alternative C and a lower motorized setting within inventoried roadless areas than alternatives A and D.

Table 42 shows that the largest class of winter recreation opportunity spectrum class is primitive (36 percent), followed by semi-primitive non-motorized (32 percent) and then semi-primitive motorized (30 percent). This alternative provides 68 percent winter non-motorized setting and 31 percent of winter motorized setting within inventoried roadless areas on the Forest. This alternative would provide a higher amount of winter non-motorized setting of the inventoried roadless areas on the forest compared to alternatives A and D and a lower amount than alternative C. Conversely, this alternative provides a higher amount of motorized setting within inventoried roadless areas on the forest compared to alternative C and a lower amount than alternatives A and D.

Roadless characteristics would be maintained with this alternative, and some timber harvesting for multiple use may occur following Forest Service policy on road construction and tree cutting in these areas.

Alternative C

Table 43 displays that this alternative has 94 percent of MA 1b (recommended wilderness) which unsuitable for timber production nor is timber harvest allowed. Although some restoration activity (e.g. whitebark pine planting, prescribed burning, protecting superior whitebark pine trees) is suitable where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintain and protect. Management areas 2a, 2b, 3b, 4a, 5a, 5b, 5c, 5d and 6a are unsuitable for timber production although low levels of timber harvest for multiple-use purposes, for salvage logging and to achieve desired vegetation conditions could occur. About 94 percent of inventoried roadless areas on the Forest are allocated to recommended wilderness and a small percentage (1 percent) to backcountry MAs with 1 percent to MA 6a. This alternative has the highest amount of inventoried roadless areas allocated to recommended wilderness.

Table 43. Indicators for alternative C

Indicator	Measure
Percentage in MA 1b (recommended wilderness)	94%
Percentage in MAs 2a and 2b (designated and eligible wild and scenic rivers)	3%
Percentage in MA 3b (special areas)	0 acres
Percentage in MA 4a (research natural areas)	2%
Percentage in MA 5a-d (backcountry)	1%
Percentage in MA 6a (general forest low)	1%
Percentage of summer recreation opportunity spectrum classes	primitive 98%, semi-primitive non-motorized 1%, roaded natural 1percent, semi-primitive motorized <1%
Percentage of winter recreation opportunity spectrum classes	primitive 98%, semi-primitive non-motorized 1%, semi-primitive motorized 1%, roaded natural <1%

Table 43 shows that the largest class of the recreation opportunity spectrum for both summer and winter is primitive at 98 percent. Combining primitive with semi-primitive non-motorized provides a non-motorized setting on 99 percent of the inventoried roadless areas compared to alternative A which would provide a summer non-motorized setting on 65 percent of the inventoried roadless areas of the forest. Alternative C provides the highest amount of non-motorized settings within inventoried roadless areas on the forest of all the alternatives and gives the highest protection to roadless characteristics of the inventoried roadless areas as 94 percent of inventoried roadless areas on the Forest are allocated to recommended wilderness. Conversely, alternative C provides the least amount of motorized settings within inventoried roadless areas on the Forest.

Roadless characteristics would be maintained with this alternative, and some timber harvesting for multiple use may occur following Forest Service policy on road construction and tree cutting in these areas.

Alternative D

As shown in table 44, MAs 2a, 2b, 3b, 4a, 5a, 5b, 5c, 5d and 6a are unsuitable for timber production although low levels of timber harvest for multiple-use purposes, for salvage logging and to achieve desired vegetation conditions could occur. None of the inventoried roadless areas is allocated to recommended wilderness with this alternative; a large percentage (88 percent) is allocated to backcountry MAs – which varies from no motorized to wheeled motorized and motorized over-snow vehicle use in a backcountry setting. This alternative allocates 4 percent to MA 6a. This alternative has the least amount of area allocated to recommended wilderness.

Table 44. Indicators for alternative D

Indicator	Measure
Acres in MA 1b (recommended wilderness)	0 acres
Acres in MAs 2a and 2b (designated and eligible wild and scenic rivers)	3%
Acres in MA 3b (special areas)	3%
Acres in MA 4a (research natural areas)	2%
Acres in MA 5a-d (backcountry)	88%
Acres in MA 6a (general forest low)	4%
Percentage of summer recreation opportunity spectrum classes	semi-primitive non-motorized 57%; semi-primitive motorized 35%; roaded natural 5%, primitive 3%;
Percentage of winter recreation opportunity spectrum classes	semi-primitive non-motorized 59%; semi-primitive motorized 36%; primitive 3%; roaded natural 1%

Table 44 shows the largest classes of summer recreation opportunity spectrum are semi-primitive non-motorized (57 percent), semi-primitive motorized (35 percent) and primitive (3 percent). The primitive setting, when combined with semi-primitive non-motorized setting provides a non-motorized setting on 60 percent of the inventoried roadless areas on the Forest. Conversely, this alternative provides a motorized setting on 40 percent of the inventoried roadless area on the Forest.

Table 44 shows the two largest classes of winter recreation opportunity spectrum are semi-primitive non-motorized (59 percent), semi-primitive motorized (36 percent) and primitive (3 percent). The primitive setting, when combined with semi-primitive non-motorized setting, provides a non-motorized setting on 62 percent of the inventoried roadless areas on the inventoried roadless areas

on the Forest. Conversely, this alternative provides a motorized setting on 37 percent of the inventoried roadless area on the Forest. This alternative provides the least amount of summer and winter non-motorized setting of all the alternatives.

Roadless characteristics would be maintained with this alternative, and some timber harvesting for multiple use may occur following Forest Service policy on road construction and tree cutting in these areas.

Consequences to inventoried roadless areas from Forest Plan components associated with other relevant resource programs

Effects of MA prescription

Alternative D has the most amount of inventoried roadless areas allocated in backcountry MAs with alternative B the second highest and alternative C the third highest. The backcountry MA ranges from no motorized use suitable to wheeled motorized and motorized over-snow vehicle use suitable. Alternative D has the highest amount of inventoried roadless area allocated to general forest low compared to alternatives B and C. General forest low MA are generally located in areas with a higher level of other resource considerations or site limitations that would restrict active vegetation management such as inventoried roadless area or grizzly bear habitat and is not part of the suitable timber base. Alternative C has the most amount of inventoried roadless area allocated to recommended wilderness, followed by alternative B, A and D.

Effects from fire and fuels management

Effective fire suppression, insect and disease infestations, and vegetation and fuel types on the Flathead National Forest have led to excessive fuel buildup in some areas. Lightening caused fires may be managed to meet resource benefits to trend vegetation towards desired conditions. Likewise, prescribed fire may be used to trend vegetation towards the desired conditions while serving other important ecosystem functions.

Inventoried roadless areas allocated to the MA5a-d would use prescribed fire and natural, unplanned ignitions to meet resource objectives as the primary mechanism for managing vegetation. The use of natural, unplanned ignitions would be more likely in alternative C, which emphasizes the use of natural disturbances and 97 percent of inventoried roadless areas are allocated to recommended wilderness.

Prescribed fire and the use of natural, unplanned ignitions would continue the long-term ecological processes in these areas. There could be a temporary loss of vegetation, reduction in water quality due to sedimentation, and air pollution. These activities generally would not affect the roadless character. Visitors could expect temporary access restrictions during periods of fire use activities.

Prescribed fire and the use of natural, unplanned ignitions could affect primitive recreation, although recreational use of burned-over areas may drop for a period of years after the fire. Lethal fire in heavy timber stands would also increase trail maintenance needs from continued downfall of snags across trails.

Effects from vegetative management

No timber harvesting would occur in MAs 1b although restoration activities could occur where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintained and protected. In the MAs 2a, 2b, 3b, 4a, 5a, 5b, 5c, 5d and 6a timber harvest is

expected to be limited and generally would be done for purposes that would result in retaining natural integrity of the ecosystem. Timber harvesting that is done to reduce hazardous fuels may be more intensive and change the undeveloped characteristics, to some degree, until vegetation regrows. This is most likely to happen on the edges of a roadless area nearer communities. Any timber harvesting within these areas would meet the requirements of the 2001 Roadless Area Conservation Rule.

Effects from recreation and access

Opportunities for primitive and non-motorized recreation would be found in inventoried roadless areas. Inventoried roadless areas that are assigned to other MAs will be managed for the mapped desired recreation opportunities classes. The existing settings are generally fall into primitive, semi-primitive non-motorized or semi-primitive motorized classes.

Trail maintenance and new trail construction is usually compatible with maintaining the undeveloped character of inventoried roadless areas

In inventoried roadless areas allocated to recommended wilderness foot and horse travel will be permitted except in the Jewel Basin Hiking Area where stock use is prohibited. In alternative C, inventoried roadless areas allocated to recommended wilderness MAs, motorized and mechanized transport would be prohibited. In alternative B, inventoried roadless areas allocated recommended wilderness existing motorized uses and mechanized transport would be allowed to continue as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintained and protected.

Inventoried roadless areas not recommended for wilderness may have a variety of motorized or mechanized transport opportunities depending on the MA assigned and the desired recreation opportunity spectrum as mapped. Alternative C provides the highest amount of primitive and semi-primitive non-motorized class than alternatives B, A, and D.

Effects of mineral development

These areas are not withdrawn from mineral entry. Mining activities can result in both short-term and long-term effects from associated structures, roads, vegetation clearing, and general ground-disturbing activities.

Cumulative effects

Cumulative effects are past, present, and reasonably foreseeable future actives that were considered with regard to cumulative effects to the roadless resource. Cumulative effects have been considered for the life of the Plan. The area of consideration is the Flathead National Forest. Reasonable and foreseeable actions on NFS lands include: future vegetation management, mining/reclamation, population growth in adjacent areas, expansion of ski areas, and reduction of fuels in wildland urban interface.

Population growth and development increases the need for public open space. Growth in Flathead, Lake and Lincoln counties is expected to increase recreation use of the Forest including an increase in use within inventoried roadless areas. The effects of urbanization and population growth on inventoried roadless areas and resource conditions are likely to be gradual and extend beyond the planning period.

Inventoried roadless area characteristics are changed by development such as roads, timber management, recreation facilities, reservoirs, etc. The development of roads and management of

vegetation has affected roadless areas in the past. Since the mapping of roadless areas in 1999 and the 2001 Roadless Area Conservation Rule (36 CFR 294 Subpart B), there have been fewer developments which have changed the roadless characteristics of inventoried roadless area. The alternatives rank C, B, A, and D from the most to least area retaining a roadless character over the next 15 years.

3.16 Wild and Scenic Rivers

Congress passed the National Wild and Scenic Rivers System Act in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) for the purpose of preserving rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Act is recognized for safeguarding the special character of these rivers, while also allowing for their appropriate use and development. The Act promotes river management across political boundaries and public participation in developing goals for river protection.

The Flathead National Forest has one designated wild and scenic river, the Flathead River, which has three forks – the South Fork, Middle Fork and North Fork that were designated by Congress in 1976 for a total of 219 miles. The Flathead National Forest cooperatively manages the North Fork and portions of the Middle Fork of the Flathead with Glacier National Park; Flathead National Forest is the lead management agency.

For wild and scenic rivers, the designated management boundaries generally average one-quarter mile on either bank in the lower 48 states. The purpose of this one-quarter mile management corridor is to protect river-related values. For management purposes, river segments are classified as *wild*, *scenic*, or *recreational*.

- **Wild River Areas** – Those 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. These represent vestiges of primitive America.
- **Scenic River Areas** – Those 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 Areas** – Those 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.

3.16.1 Legal and administrative framework

Law and executive orders

Wild and Scenic Rivers Act of October 2, 1968 (P.L. 90-542, 82 Stat. 906, as amended): This act establishes a National Wild and Scenic Rivers System with three classes of river systems: wild, scenic, and recreation. The purpose of the act was to protect the river "…for the benefit and enjoyment of present and future generations."

3.16.2 Key indicator

- Miles of designated and eligible wild and scenic rivers

3.16.3 Methodology and analysis process

Information sources and analysis

Information source is the Flathead National Forest GIS.

Analysis area

The analysis area is the geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years)

3.16.4 Affected environment (existing condition)

Designated Rivers

North Fork of the Flathead River

The North Fork of the Flathead is cooperatively managed with Glacier National Park. Glacier National Park manages the east side of the river as recommended wilderness and has specific permitted use and regulations. The headwaters of the North Fork of the Flathead originate in Canada.

Upper North Fork Segment is mostly classified as a *scenic river* and is about 37 miles long. The outstanding remarkable values for this segment are: fisheries, geologic, water quality, wildlife, botanic, recreation, scenic, historic and ethnographic. A large portion of river users on this stretch of river is non-outfitted. Commercial outfitting use is capped at days 670 service days.

The lower North Fork Segment is classified as recreational river and is about 21 miles long. The outstanding remarkable values for this segment are: fisheries, geologic, water quality, wildlife, recreation, historic and ethnographic. Motorized use is allowed from Big Creek River Access to Blankenship (confluence of Middle Fork). This section of the North Fork provides more whitewater opportunities with 3 class III rapids below Great Northern Flats. Commercial outfitting use is 387 priority service days and unlimited temporary use.

Middle Fork of the Flathead River

The upper Middle Fork segment of the Middle Fork is classified as a wild river with about 33 miles within the Great Bear Wilderness and 14 miles in the Bob Marshall Wilderness. The outstanding remarkable values for this segment are: fisheries, geologic, water quality, wildlife, botanic, recreation, scenic, and historic. Commercial outfitting use is capped at 456 priority service days.

The lower Middle Fork segment is classified as a recreational river and is about 49 miles long. The outstanding remarkable values for this segment are: fisheries, geologic, water quality, wildlife, recreation, scenic, and historic. The Glacier National Park side is mostly recommended wilderness and is managed like designated wilderness. This section of river has the highest recreation use and high volume outfitter use with 36,125 priority use days and unlimited temp use days.

South Fork of the Flathead River

The upper South Fork section has a 41-mile section within the Bob Marshall Wilderness that is classified as wild river. The section from Meadow Creek Gorge to Spotted Bear Ranger is an 11 mile section classified as wild river and is the only wild section outside of wilderness in the Flathead Wild and Scenic River system. The wild section is managed similar to wilderness.

The lower South Fork section is from the footbridge at Spotted Bear Ranger Station to the confluence of the Spotted Bear River: This 9 mile section of river is classified as a recreational river. Motorboats are allowed and limited to 10 horse power. This river segments offers a slower paced float, with just a few class I and II rapids.

Eligible rivers

Refer to appendix 5 for detailed information on the eligible wild and scenic river process.

Table 45. List of eligible wild and scenic rivers, their segments, potential classification, outstandingly remarkable values and length

River	Segment	Potential Classification	Outstandingly Remarkable Values	Length (miles)
Aeneas	Headwaters to Hungry Horse Reservoir	Scenic	History, prehistory, recreation, scenery	5
Big Salmon	Lena Lake to South Fork of Flathead River, includes Big Salmon Lake.	Wild	Recreation, geology, fish, prehistory	19
Clack Creek	Headwaters to Middle Fork of Flathead River	Wild	Geology, scenery	8
Danaher	Headwater to Youngs Creek.	Wild	Scenery, recreation, fish, wildlife, history, prehistory, botany, natural areas	23
Elk	Headwaters to forest boundary	Scenic	Fish	10
Gateway	Headwater to Strawberry Ck	Wild	Scenery, geology, history	5
Glacier	Headwaters to outlet of Glacier Slough	Wild: within Mission Mountains Wilderness; Scenic: wilderness boundary to outlet of Glacier Slough	Geology, wildlife, scenery	6
Graves	Headwaters to Hungry Horse Reservoir	Wild: within Jewel Basin; Scenic: from boundary of Jewel Basin to Hungry Horse Reservoir	Prehistory	10
LeBeau	Headwater to LeBeau research natural area boundary	Wild	Scenic, geological, natural area	4
Lion	Source to Lion Creek TH	Scenic	Wildlife	11
Little Salmon	Headwater to South Fork of Flathead River	Wild	Scenery, fish, prehistory	19
Logan	From Rd 539 to Tally Lake	Recreation	Scenic, recreational	4
Schafer	Headwaters to Middle Fork of Flathead River	Wild	Prehistory, history	11
Spotted Bear	Headwater to South Fork of Flathead River	Wild: headwaters to end of Blue Lake Recreation: Blue Lake to SF of Flathead	Recreation, wildlife, geology	35
Strawberry	Headwaters to Middle Fork of Flathead River	Wild	Fish	14

River	Segment	Potential Classification	Outstandingly Remarkable Values	Length (miles)
Lower Swan River	Swan River State Forest to Swan Lake	Recreation	Wildlife	11
Upper Swan River	Crystal Lake to Confluence with Lindbergh Lake	Wild	Recreation	2
Whale	Headwaters to FS boundary	Scenic: Headwaters to confluence to Shorty Creek; Recreation: Shorty Creek to FS boundary	Wildlife	21
White River	White River	Wild	Geology, fish, history, prehistory, scenery	24
Yakinikak	From confluence with Nokio Creek to confluence of Thoma and Trail Creeks	Scenic	Fish, prehistory, geology, wildlife	8
Trail	Confluence of Thoma and Yakinikak Creeks to FS boundary in sec 29.			2
Nokio	From the confluence of unnamed stream just south of road 114, to confluence with Yakinikak Creek.			3
Youngs	Headwaters to South Fork of the Flathead	Wild	Fish, recreation, prehistory, history, scenery	23
				278

a. Total acres are more than those shown in volume 1, table 4, because of overlapping MAs. As noted with section 2.7 of volume 1, several MAs are higher in the hierarchy than MA 2b. There are 46,790 acres of MA2b within MA1a, 10,731 acres in MA1b, and 1,325 acres in MA 4a.

3.16.5 Environmental consequences

Effects common to alternatives A, B, C and D

Under all alternatives, eligible rivers would be managed according to Forest Service policy and MA 2b direction and would be managed to protect the free-flowing condition of designated wild and scenic rivers and preserve and enhance the values for which they were established. Therefore, the management of eligible segments under Forest Service policy would be the same for alternatives A, B, C and D.

Consequences to designated or eligible wild and scenic rivers from forest plan components associated with other relevant resource programs

Effects of MA prescription

The MA prescription for wild and scenic rivers protects the free-flowing conditions and outstandingly remarkable values for which the river was designated as eligible. All alternatives have equal amounts of eligible rivers.

Effects from fire and fuels management

Both natural, unplanned ignitions and prescribed fires are allowed to be used as a tool to maintain ecological conditions within river corridors as long as the outstandingly remarkable values for which the scenic or recreational river was identified are protected and maintained.

Effects from vegetative management

Eligible wild classified rivers are not suitable for timber production and timber harvest is not allowed. There would be no effects from timber harvest on those segments. On eligible recreational or scenic classified rivers, timber production is not suitable but timber harvest is allowed for multiple-use purposes, for salvage logging, and to achieve desired vegetation conditions. Any timber harvest would protect the identified outstandingly remarkable value.

Effects from recreation and access

Impacts from recreational use and management within eligible river segments are anticipated to be low. Although river corridors may be used for camping, canoeing, hiking, and other activities, the impacts are expected to remain at existing levels. In order to provide an essentially primitive character, eligible segments classified as wild generally would not have developed recreation sites. Dispersed sites may occur in river corridors. In segments classified as scenic or recreational, recreation development would be allowed when it would protect and maintain the outstandingly remarkable values for which the river was deemed eligible for. Trail maintenance work can be expected to have little if any impact in the river corridors.

Effects of mineral development

Anticipated effects from minerals management would be low in all alternatives. Eligible rivers with scenic or recreation classification areas are not withdrawn for mineral entry and are suitable for mineral exploration and development while protecting and maintaining the outstandingly remarkable values for which the river was deemed eligible for. Designated and eligible segments classified as wild would not be available for mineral material development.

Potential for leasable minerals is low across most of the Forest and currently there are no permits or operating plans for exploration within the corridors. Although potential for locatable minerals does exist, there are no current permits or operating plans for mineral exploration within the corridors. Mineral materials are present and could potentially be used for construction purposes but generally proposals for development of mineral materials do not occur and this would be at the discretion of the Forest Service.

Cumulative effects

Cumulative effects evaluate the potential impacts to wild and scenic rivers from the alternatives when combined with past, present, and reasonably foreseeable actions. The lands within the Flathead National Forest boundary, and the named rivers and streams contained therein, form the geographic scope for cumulative effects. The temporal bound would be the life of the Forest Plan which is estimated to be a 15 year time span.

In order to integrate the contribution of past actions to the cumulative effects of the proposed action and alternatives, existing conditions are used as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior actions that have affected wild and scenic rivers and might contribute to cumulative effects. Water-related activities such as fishing, rafting, kayaking, and similar uses are expanding as the population in the nearby urban areas increases and access points are developed.

On rivers that predominantly flow through NFS lands, there has been a steady increase in water-related activities such as fishing, rafting, canoeing, and kayaking, mostly at dispersed sites.

Management activities generally take place outside of eligible wild and scenic rivers unless an action is needed to help protect or preserve the identified unique feature or characteristic. For example, if invasive weeds were discovered in an eligible river corridor there may be a need to take some action (hand pull, herbicide application) to eradicate or prevent further spread.

3.17 National Scenic Trails

3.17.1 Legal and administrative framework

Law and executive orders

Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136): This act provides the statutory definition of wilderness and management requirements for these congressionally designated areas. This act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness.

National Forest Management Act (NFMA) of 1976, as amended (16 U.S.C. 1600): Provides that management direction for wilderness be incorporated into Forest Plans and sets minimum standards for the content of the Plans.

The National Trails System Act: Established a national trails system.

Executive Order 13195 of January 18, 2001: Trails for America in the 21st Century

Public Law 111–11: Omnibus Public Land Management Act of 2009 authorized the Pacific Northwest Scenic Trail as an addition to the National Scenic Trail system.

Code of Federal Regulations

- **36 CFR 293**: Wilderness–Primitive Areas
- **36 CFR 261.18**: Prohibitions in National Forest Wilderness.

Other policy

- The Continental Divide National Scenic Trail Comprehensive Plan

3.17.2 Indicators, methodology and analysis process

Effects to National Scenic Trails is indicated by evaluating the difference in management activity by looking at the assigned management areas by alternative as well as the recreation opportunity spectrum class allocation by alternative.

- Management areas the national scenic trails goes through
- Recreation opportunity spectrum settings the national scenic trails goes through.

Information sources

The Forest Service's GIS is used.

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years)

3.17.3 Affected environment (existing condition)

Continental Divide National Scenic Trail

The Continental Divide National Scenic Trail also known as the Continental Divide Trail is a National Scenic Trail running 3,100 miles between Mexico and Canada. It follows the Continental Divide of the Americas along the Rocky Mountains and traverses five U.S. states: Montana, Idaho, Wyoming, Colorado, and New Mexico. The trail is a combination of dedicated trails and roads.

There are 18 miles of the Continental Divide National Scenic Trail on the Flathead National Forest, which include Badger Creek Trail # 147, Strawberry Creek Trail # 161, Bowl Creek Trail # 324 and Sun River Pass Trail # 116. This section of the Continental Divide Trail on the Flathead National Forest is within designated wilderness (Bob Marshall Wilderness); there is about 1 mile of the trail which leaves the Flathead National Forest, goes into the Lewis and Clark/Helena National Forest, crosses back into the Flathead National Forest and then back into the Lewis and Clark/Helena National Forest. There is a mile-wide corridor for the trail where plan components tier to. Refer to figure B-30.

Pacific Northwest National Scenic Trail

The Pacific Northwest National Scenic Trail begins near the Continental Divide in Glacier National Park and travels more than 1,200 miles through Montana, Idaho, and Washington before reaching its western terminus at the Pacific Ocean near Cape Alava. There are about 28 miles of the Pacific Northwest National Scenic Trail on the Flathead National Forest. There is a mile-wide corridor for the trail where plan components tier to. Going east to west starting at Glacier National Park on Polebridge Ranger Station Road, the trail sections include (Refer to figure B-28):

- Polebridge Ranger Station Road # 107F
- Glacier Road (county road) Road # 6055
- Polebridge Loop (county road) Road # 60054
- North Fork Road (county road) Road # 486
- Hay Creek (NFS road) Road # 376
- Hay Creek Trail # 3
- Whitefish Divide Ralph Thayer Trail# 26
- Whitefish Divide Trail # 26 then goes on to the Kootenai National Forest, Blue Sky Trail # 72.

3.17.4 Environmental consequences

Continental Divide Scenic Trail

Effects common to all alternatives

None of the alternatives would affect the section of the Continental Divide Trail on the Flathead National Forest which is located within the Bob Marshall Wilderness. This wilderness provides a primitive recreation opportunity setting for all alternatives. There would be no change in current direction with any alternative. Although inside of the Bob Marshall Wilderness (management area 1a), it is also partially within an eligible wild and scenic river MA (Strawberry Creek) that has a potential classification of a wild classification which is managed as wilderness. There would be no change in current direction with any alternative.

Pacific Northwest National Scenic Trail

Alternative A

The majority of this trail is within backcountry (management area 5a, 5b, 5c, and 5d) at 12 miles; general forest high (management area 6c) at 8 miles; and general forest low (management area 6a) at 7 miles. There is a small amount that goes through designated and eligible wild and scenic rivers (management areas 2a and 2b). Note that the MA crosswalk from the 1987 Forest Plan and the new MAs does not differentiate between the backcountry MAs 5a, 5b, 5c and 5d.

The primary summer recreation opportunity spectrum setting is semi-primitive non-motorized at 66 percent followed by roaded natural at 34 percent. This alternative provides a non- motorized setting on 66 percent and a motorized setting on 34 percent.

The primary winter desired recreation opportunity spectrum setting is semi-primitive motorized at 74 percent which provides a motorized setting, followed by semi-primitive non-motorized at 26 percent which provides a non-motorized setting.

Alternative B

The majority of this trail is within general forest moderate (management area 6b) at 11 miles; general forest low (management area 6a) at 7 miles; backcountry motorized over-snow vehicle use (management area 5c) at 5 miles and recommended wilderness (management area1b) at 4 miles. There is a small amount that goes through designated and eligible wild and scenic river (management areas 2a and 2b).

The primary summer desired recreation opportunity spectrum setting is roaded natural at 57 percent followed by semi-primitive non-motorized at 23 percent and primitive at 19 percent. This alternative provides a motorized setting on 58 percent of the area and a non-motorized setting on 42 percent. Compared to alternative A, this alternative provides less summer non-motorized setting and a higher summer motorized setting than A. This alternative provides less non-motorized setting than alternative C but more than alternative D. Conversely, it provides a higher motorized setting than alternatives A and C but less than alternative D.

The primary winter desired recreation opportunity spectrum setting is semi-primitive motorized at 53 percent, followed by semi-primitive non-motorized at 26 percent, primitive at 19 percent and roaded natural at 3 percent. This alternative provides a motorized setting on 56 percent and a non-motorized setting on 45 percent. Compared to alternative A, this alternative provides a higher amount of non-motorized setting than alternative A and a lower amount of motorized setting than A.

This alternative provides less non-motorized setting than alternative C but more than alternatives A and D. Conversely, it provides a higher amount of motorized setting than alternative C but less than alternatives A and D.

Alternative C

The majority of this trail is within backcountry motorized over-snow vehicle use (management 5c) at 9 miles; recommended wilderness (management area1b) at 7 miles; general forest low (management area 6a) at 6 miles and general forest moderate (management area 6b) at 3 miles. There is a small amount that goes through designated and eligible wild and scenic rivers (management areas 2a and 2b) for less than 1 mile.

The primary desired summer recreation opportunity spectrum setting in the corridor is semi-primitive non-motorized at 41 percent followed by primitive at 32 percent, than roaded natural at 17 percent and semi-primitive motorized at 10 percent. This alternative provides a non-motorized setting with 73 percent of the area and a motorized setting on 35 percent of the area. Compared to alternative A, this alternative provides a higher amount of non-motorized setting and a lower amount of motorized setting than A. This alternative provides the lowest amount of motorized setting than alternatives A, B and D. Conversely, it provides the highest amount of non-motorized setting than alternatives A, B and D.

The two primary winter recreation opportunity spectrum setting is semi-primitive motorized at 33 percent and semi-primitive motorized at 33 percent, followed by primitive at 32 percent, and roaded natural at 3 percent. This alternative provides a motorized setting on 36 percent and a non-motorized setting on 65 percent. Compared to alternative A, this alternative provides a higher non-motorized setting and a lower motorized setting than A. This alternative provides the highest amount of non-motorized setting than alternatives A, B and D. Conversely, it provides the lowest motorized setting than alternatives A, B and C.

Alternative D

The majority of this trail is within general forest moderate (management area 6b) at 8 miles; backcountry motorized over-snow vehicle use (management area 5c) at 8 miles; general forest - low (management area 6a) at 7 miles; general forest - high (management area 6c) at 3 miles; and backcountry non-motorized (management area 5a) at 1 miles. There is a small amount that goes through designated and eligible wild and scenic river (management areas 2a and 2b).

The primary summer desired recreation opportunity spectrum setting in the corridor is roaded natural at 59 percent followed by semi-primitive non-motorized at 23 percent and semi-primitive motorized at 18 percent. This alternative provides a motorized setting on 77 percent and a non-motorized setting on 23 percent of the area. Compared to alternative A, this alternative provides a higher amount of motorized setting than A and a lower amount of non-motorized setting than A. This alternative provides the highest amount of motorized setting than alternatives A, B and C. Conversely, it provides the lowest amount of non-motorized setting than alternatives A, B and C. The primary winter recreation opportunity spectrum setting is semi-primitive motorized at 65 percent, followed by semi-primitive non-motorized at 33 percent, and roaded natural at 3 percent. This alternative provides a motorized setting on 68 percent and a non-motorized setting on 33 percent. Compared to alternative A, this alternative provides a higher amount of non-motorized setting than A and a lower amount of motorized setting than A. This alternative provides a higher amount of motorized setting than alternatives B and C and less than alternative A. Conversely, this alternative provides a higher amount of non-motorized setting than alternative A and less than alternatives B and C.

Cumulative effects

Cumulative effects evaluate the potential impacts to the two national scenic trails from the alternatives when combined with past, present, and reasonably foreseeable actions. The lands within the Flathead National Forest boundary, as well as the Continental Divide Trail System and the Pacific Northwest Scenic Trail System form the cumulative effects area. The temporal bound would be the life of the Forest Plan which is estimated to be a 15 year time span.

In order to integrate the contribution of past actions to the cumulative effects of the proposed action and alternatives, existing conditions are used as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior actions that have affected the Continental Divide Trail System and the Pacific Northwest Scenic Trail System and might contribute to cumulative effects. Recreational activities such as hiking, camping, mountain biking, and similar uses are expanding as the population in the nearby urban areas increases.

Management activities generally that would affect the Continental Divide Trail on the Flathead National Forest (which is within designated wilderness on the Forest) are generally those that allow natural processes to occur such as fire and insect and disease. Recreational use may increase on the trail, with users having more contact with other visitors which may affect the solitude characteristics.

Management activities generally that would affect the Pacific Northwest National Scenic Trail could be vegetation management, road reconstruction, fire suppression, and increase in recreational use.

3.18 Special Areas

3.18.1 Introduction

Special areas are a category of administratively designated areas, defined as an area or feature managed to maintain its unique special character or purpose (36 CFR 219.19). This special character may be of various form, including botanical, geological, or recreational in nature. The Forest has one existing designated special area, with an additional eleven special areas proposed in the draft revised forest plan.

3.18.2 Legal and administrative framework

Code of Federal Regulations (CFR): 36 CFR 219.7 – Planning Rule: States that in developing a proposed plan revision, the responsible official shall identify existing designated areas and determine whether to recommend any additional areas for designation. Forest plans must include components for appropriate management of existing or proposed designated areas.

Forest Service Manual 2372 – Administratively designated areas: Contains purpose, policy and guidance for administrative designation of special areas.

3.18.3 Methodology and analysis process

Flathead Forest Resource specialists have identified the areas on the Forest that possess the characteristics which make them suitable for establishment as special areas. The areas acknowledge and highlight what are considered special natural features of the Forest, as well as an opportunity to provide public appreciation, education and enjoyment. Input from members of the public was also considered in the selection of special areas.

Documentation of conditions within the special areas comes from reports and records for individual areas (where available) and from local and regional resource specialist knowledge.

Incomplete and unavailable information

Recent surveys and other sources of information on vegetation conditions within some of the special areas are limited.

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years).

3.18.4 Affected environment (existing condition)

Table 46 below lists the special areas both existing and proposed on the Forest. All are identified on the basis of their special botanical features, as described in the table and in the descriptions which follow the table. The acres within the fen special areas include a 300-foot riparian management zone buffer adjacent to the fen. Refer to figure B-50 to B-52 for maps displaying location of the special areas (management area 3b).

Table 46. Existing and proposed special areas on the Forest

Name	Location/Ranger District (RD)	Special character and features	Acres
Condon Creek Botanical Area (existing)	Swan Valley, Swan Lake RD	Concentration of pond habitats occupied by water howellia, a federally threatened plant species. Associated upland mixed conifer forest, featuring several groves of mature ponderosa pine, as well as western larch and Douglas-fir.	226
Bent Flat Fen (proposed)	Spotted Bear River, Spotted Bear RD	A unique, extremely rich fen with well-developed patterning, extensive marl deposits, and a large number of rare plants that are restricted to calcareous habitats. The Trail Creek Fire in August of 2015 burned the forests surrounding and immediately adjacent to the fen.	44
Gregg Creek Fen (proposed)	Salish Mountains, Tally Lake RD	Features peatland and wet forest and shrub communities within an undisturbed portion of the Gregg Creek watershed. Rare plants present.	33
Lost Creek Fens (proposed)	Swan Valley, Swan Lake RD	Lost Creek Fens contain two distinctly different types of fens separated by a patch of moist coniferous forest. The northern fen is at the toe of a slope. An upwelling spring supplies water to a thick accumulation of peat which gently slopes to the south. The southern fen has two shallow potholes filled with peat and alluvium. The water table fluctuates seasonally; drawdown in the fall hastens peat decomposition and minimizes peat accumulation. A number of rare plant species are present at both sites.	36
Meadow Lake Fen (proposed)	Swan Lake RD	One of the few places on the forest that has a floating organic mat. Rare plants present. Loons and bog lemmings have also been observed at this lake.	62

Name	Location/Ranger District (RD)	Special character and features	Acres
Porcupine Creek Fens (proposed)	In tributary of Porcupine Creek, Swan Lake RD	Features two fens, which are part of a larger complex of fens. Porcupine Fen is at the toe of a slope from which several springs emerge. This constant supply of mineral-rich water has favored the accumulation of organic matter. The site supports a diverse flora. The site is largely ringed by wet to moist spruce forests, except on a portion of the west margin, where a harvested areas upslope of the fen extends down nearly to the fen. The site is an excellent example of a flow-through fen. A number of rare plants occur.	115
Sanko Creek Fen North (proposed)	Salish Mountains, Tally Lake RD	Features two wetland areas. One is a small pond, up to 3 to 4 meters deep, and surrounded by a floating to anchored organic mat and a wet meadow. The other wetland is a north-south oriented fen. The fen is surrounded by moist spruce forest. The fen has a series of broad, gently sloping terraces with interspersed water tracks and upwelling pools of water. Western larch is common on adjacent uplands. Rare plant species have been observed at the site.	49
Sanko Creek Fen South (proposed)	Salish Mountains, Tally Lake RD	Oriented east-west along the base of a slope. A number of seeps and springs emerge from the toe of this slope and maintain wet conditions in the peatland. One rare plant species has been observed here, as well as a possible bog lemming sighting	23
Trail Creek Fen (proposed)	Spotted Bear River, Spotted Bear RD	A relatively large, highly calcareous peatland. The site contains three abandoned beaver dams and ponds and a well-developed peatland on the upper easternmost portion of the wetland. Several rare plants occupy this relatively large, well-developed peatland.	98
Trout Creek Fen (proposed)	Hungry Horse RD	Trout Lake is an excellent example of an organic mat (floating and anchored) surrounding a deep pond. A sedge meadow lies southwest of the pond. Several species of sphagnum moss form a nearly continuous carpet adjacent to the pond. Rare plant species are known from the peat mat. The site is easily accessible by motor vehicle, and supports a handicapped-accessible fishing dock. Most of the organic mat, however, is undisturbed by human use.	34
Windfall Creek Fen (proposed)	Swan Valley, Swan Lake RD	Occupies a basin formed by glacial scouring. Rare plant species have been observed here.	31
Glacier Slough (proposed)	Glacier Creek, south end of the Swan Valley, Swan Lake RD	One of the largest wetlands in the Swan Valley, with a diversity of wetland and riparian associated plant and animal species, and adjacent forests of mixed conifer species.	1,690
Johnson Terrace (proposed)	Evers Creek, a tributary of Logan Creek, Tally Lake RD	Includes mossy forb meadow on shallow residual soils over a Pre-Cambrian argillite bedrock dip slope that is inundated with water in the spring and dries out during summer. There are many diminutive plants that are restricted to this type of ephemeral spring habitat. In addition to botanical features, contains geologic/topographic features that harbor a diversity of plants unique among the forested landscape.	331

Name	Location/Ranger District (RD)	Special character and features	Acres
Fatty Creek Cedars (proposed)	Swan Lake RD, in Fatty Creek	Moist, riparian-associated western redcedar forest type, supporting stands dominated by very large, old cedar trees and associated unique assemblages of understory plants. Provides aesthetic values associated with “ancient” cedar groves. Groves such as this are relatively rare on the Forest, due to the limited area with suitable site conditions for their development, past fire disturbance, and to removal through previous logging or development activities.	261
Total Acres			3,033

Existing special area - Condon Creek Botanical Area

This Special Area is located on the Swan Lake Ranger District, lying in the central portion of the Swan Valley. Retreating glaciers left large blocks of ice embedded in till, resulting in numerous ponds and wetlands throughout the Swan Valley. The topography of the site is rolling with alternating swales and small ridges, and contains fifteen ponds. Condon Creek, forming the north boundary of the botanical area, flows west into the Swan River.

The primary purpose of the Condon Creek Botanical Area is to protect a concentration of pond habitats occupied by water howellia, a federally-listed threatened plant species (see section on At-Risk Plants within this EIS). Nine ponds support populations of water howellia within the botanical area. Adjacent uplands support forests of lodgepole pine, western larch, Douglas-fir and ponderosa pine. Opportunity for research and education on water howellia and its habitat, and the associated upland forested areas, is another purpose for this botanical area.

Proposed special areas

Thirteen special areas are proposed in the Revised Forest Plan. Ten of these areas contain fens, selected because they are considered to be important representatives for this type of wetland on the Forest. The remaining three contain other botanical or geological features considered of unique and special interest in the Forest ecosystem.

Fen and wetland special areas

Fens are peat-forming wetlands, and receive nutrients and water from underground sources. They are characterized by their water chemistry which, in contrast to bogs, is usually less acidic and has higher nutrient and mineral levels. They therefore support a much more diverse plant and animal community. They are often covered by grasses, sedges, rushes and wildflowers, with unique assemblages of species connected to the water regime and nutrient conditions of each fen.

Fens, like bogs and other wetlands, provide important benefits in a watershed, including preventing or reducing the risk of floods, improving water quality, and providing habitat for unique and often rare plant and animal communities. Up to 10,000 years are required to form a fen naturally. Extensive losses in wetland acres have occurred across the U.S. since the mid-1700s, primarily through draining and converting to other uses (Dahl 1990). Beginning in the 1970s, the rate of wetland losses slowed substantially as a result of changes in national and state wetland policies and heightened awareness of the important benefits aquatic systems, including wetlands, bring to society.

Glacier Slough Special Area contains one of the larger wetland complexes in the Swan Valley, and is located in the Glacier Creek drainage which flows into the upper reaches of the Swan River. It

contains a complex diversity of plants associated with riparian and wetland habitats, which in turn supports a diverse array of wildlife species. The portion of Glacier Creek that lies within this special area is a proposed Eligible Wild and Scenic River in the alternatives to the existing plan (refer to Wild and Scenic River section of this EIS).

Johnson Terrace special area

Johnson Terrace is a geologic feature on the side of Johnson Mountain in the Salish Mountains. Like many rock terraces, its shallow soils support many springtime ephemeral plants that are rarely seen in such a large assembly anywhere else on the forest. One rare plant species, *Idahoa scapigera*, occurs on the terraces. Later in the season when spring runoff has ended, the terraces become grassy meadows. Elk sign is common in the area, indicating it is an important area for wildlife. Johnson Terrace is one of the largest terrace complexes on the forest and has been the subject of botanical interest for many years.

Fatty Creek Cedars special area

Western redcedar (*Thuja plicata*) is a widespread and common species in the forests of the Pacific Northwest. The Flathead Forest is at the far eastern edge of the species range. As such, its presence is relatively restricted on this Forest, and it occupies only the warmest sites, with relatively deep soils, that maintain consistent, moist conditions or in seasonally wet areas. These tend to be located in the lower elevation riparian zones and poorly drained depressions. Due to topographic, weather and soil conditions, the Swan Valley contains some of the most extensive areas of western redcedar-dominated sites on the Flathead National Forest.

Western redcedar is most commonly associated with a wide array of tree species, including Douglas-fir, western larch, western white pine, grand fir and ponderosa pine. Western redcedar is very tolerant of shade and can survive in the understory forest canopy layers for many decades. It is capable of living for several centuries, with some individuals achieving 1000 years or more. It is relatively intolerant of fire, though larger diameter trees may withstand low or even moderate severity fires. The location of western redcedar in the most moist or wet areas that are less likely to burn increases their probability of survival over time.

Western redcedar typically grows in relatively pure stands only where fire has been excluded for a long time (Barrett 1988). On this eastern edge of the species' range, western redcedar sites on the Flathead Forest tend to be drier and less productive than sites further west. Fires also tend to be more frequent in the Flathead landscape, with shorter fire-free intervals and fires that are strongly driven by weather and topography. Even the wettest zones of the forest would eventually experience a stand-replacement, high severity fire, though perhaps at intervals of several hundred years. In addition, the high economic value of large, old cedar trees and their relative accessibility led to past harvesting of many cedar stands on both NFS and private lands. As a result of all these factors, groves of very large, old cedar trees, and their associated assemblage of understory shrub and herb species, are relatively rare on the Flathead Forest. Fatty Creek Cedars Special Area encompasses an old cedar grove, and is proposed for special area designation to recognize and increase awareness of its unique ecological characteristics, to provide greater protection, and to foster educational opportunities.

3.18.5 Environmental consequences

General effects and management direction

Alternative A – no action

This alternative contains only one special area, which is the currently established Condon Creek Botanical Area. It is designated as MA 3a in the existing plan. Plan direction specifies that it would be managed in accordance with direction set in the Conservation Strategy for *Howellia aquatilis* (water howellia). There are no additional special areas under this alternative.

Though there are no proposed additional special areas in the existing plan, standards and guidelines associated with riparian habitats and wetlands in the existing plan would continue to provide protection of the plant communities and ecological values associated with the fens, Glacier Slough and most of the Fatty Creek Cedars areas, which are proposed for designation as special areas in the action alternatives.

Alternatives B, C and D

All action alternatives include the proposed designation of thirteen new special areas, in addition to the existing Condon Creek special area, as displayed in Table 39. Existing and proposed special areas are designated MA 3b in all action alternatives. As under the existing plan, the Condon Creek special area would be managed in accordance with direction set in the Conservation Strategy for water howellia, the primary feature for which it was designated.

Forest plan components under the action alternatives specify that all special areas would be managed in a substantially natural condition, where ecosystems primarily reflect the influence of natural processes. Plant and wildlife habitat values for which the special area was identified would be maintained. Invasive plant species would be controlled. Educational and research opportunities would be provided, featuring the ecological and plant communities associated with the special areas.

Specific direction for special areas would provide protection from human disturbances that would adversely affect their qualities. Vegetation management or other activities near special areas would be evaluated for potential impacts to the plant species, plant communities, and other associated qualities. The fens, and Glacier Slough and Johnson Terrace special areas would be unsuitable for new trail construction and associated structures, though existing trails that access these areas may be maintained.

Desired conditions in the revised forest plan related to providing for a healthy, functioning ecosystem within RMZs would apply to the fens, Glacier Slough and Fatty Creek Cedars Special Areas, because these areas contain RMZs. The fen and wetland special area boundaries all include a 300 foot buffer adjacent to the wetland. Guidelines and standards related to RMZs restrict management activities and disturbance in these areas.

Values and qualities associated with the existing and proposed special areas are protected equally by the forest plan components under all action alternatives, preserving the values associated with these areas. Potential for adverse effects to special areas is low, with no notable difference among the action alternatives.

Consequences to Special Areas from Forest Plan Components Associated with other Resource Programs or Revision Topics

Effects from access and recreation

Access and recreational uses would be restricted within special areas, protecting the qualities of associated with the areas. Summer wheeled motorized travel is only allowed on designated routes. Over-snow vehicle use could occur in some special areas, as identified on the over-snow vehicle use map. No new trails would be constructed in the fens, Glacier Slough or Johnson Terrace special areas. Impacts from recreational activities are expected to be low in the special areas.

Effects from fire and fuels management

Desired conditions within special areas are to maintain an ecosystem that primarily reflects the influence of natural processes. These natural processes may include fire within some areas. Most wildfires would require suppression measures for purposes of protecting values both within and outside the special areas. Prescribed fire is allowed within special areas for purposes of maintaining natural processes and desired vegetation conditions. Impacts from fire and fuels management are expected to be low.

Effects from vegetation management

Special areas are unsuitable for timber production and for commercial removal of special forest products. Vegetation management, including harvest, may occur only for purposes of maintaining the values and qualities associated with the special area. Impacts from vegetation management activities are expected to be low.

Effects from invasive species management

Invasive species control may occur in some special areas, dependent on ground conditions and control methods. For example, fens would not be treated chemically due to their hydrology, but areas like Fatty Creek Cedars or Johnson Terrace could be chemically treated when spring runoff is over and the site is suitable for treatment in accordance to herbicide chemicals and state regulations. Manual treatments are a priority method in these special areas. Biological controls would also be considered if appropriate. Control of invasive species is expected to have a positive impact on the native plant species and communities associated with the special areas.

3.18.6 Cumulative effects

Management activities generally have and will continue to take place mostly outside of the existing and proposed special areas. It is unlikely they would have an effect on the special areas, due to the distance from the areas and various plan components that protect soils, water and other resource values forestwide.

Control of invasive weeds is an action that may have occurred in the past within special areas, and is the most likely management activity to occur within special areas in the future. This would likely have a positive effect on the special areas by controlling invasive weeds or preventing their spread. There may be other vegetation treatments, such as removal of woody fuels, occurring in the future within and adjacent to some special areas, particularly the fen special areas that lie in the wildland urban interface. These fuel reduction actions may be desirable to reduce severity of potential future fires, protecting both values associated with and adjacent to the special areas. These activities are not expected to result in detrimental effects to the values associated with the special areas.

3.19 Research Natural Areas, Coram Experimental Forest, and Miller Creek Demonstration Forest

3.19.1 Introduction

The Forest contains six established research natural areas, the Coram Experimental Forest and the Miller Creek Demonstration Forest. All are administratively designated areas, which are defined as an area identified and managed to maintain its unique special character or purpose (36 CFR 219.19). The existing conditions and effects by alternative for all three of these designated area categories are discussed in this section.

3.19.2 Legal and administrative framework

Regulation, policy, and guidance

Code of Federal Regulations (CFR): 36 CFR 219.7 – Planning Rule: States that in developing a proposed plan revision, the responsible official shall identify existing designated areas and determine whether to recommend any additional areas for designation. Forest plans must include components for appropriate management of existing or proposed designated areas.

Forest Service Manual 4063: Directs management of research natural areas as part of a national network of ecological areas allocated in perpetuity for research and education and/or to maintain biological diversity on NFS lands. research natural areas are co-managed by the National Forest Service and Research Station

Forest Service Manual 4063.03: Forest Plans shall include analysis of, and recommendations for, any proposed research natural areas establishment.

Region 1 Natural Areas Assessment 1996 (Chadde et al 1996): Provided an assessment of plant community types needed to fulfill the national spectrum of types to be placed in research natural area status in Region 1.

Establishment records for each research natural area: These records provide information on the natural features, plant communities and species present in each research natural area, as well as management guidance.

3.19.3 Key indicator

The key indicator for measuring effects of alternatives is the differences between alternatives in forest plan direction guiding the management and protection of these designated areas.

3.19.4 Methodology and analysis process

Flathead Forest resource specialists and research scientists from the Rocky Mountain Research Station have identified the lands on the Forest that possess the characteristics which make them suitable for research natural area establishment. Information and management guidance for each research natural area is provided within the establishment records. A guidebook on research natural areas also provides a synopsis of the natural features protected in each research natural area, and information about use of the areas for research (Evenden et al. 2001).

The Coram Experimental Forest was established and is managed by the Rocky Mountain Research Station. The Miller Creek Demonstration Forest was jointly identified by Forest resource specialist

and research scientists as suitable for special designation as a demonstration forest. Field surveys, research information, or other available documentation of conditions within the Coram Experimental Forest and the Miller Creek Demonstration Forest, as well as local resource specialist knowledge, were used to evaluate existing conditions and potential effects by alternative.

Incomplete and unavailable information

Recent surveys and other sources of information on vegetation conditions within some of the research natural areas are limited.

Analysis area

The geographic scope of the analysis is the lands administered by the Forest. All lands within the Flathead Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (15 years).

3.19.5 Affected environment (existing condition)

Research Natural Areas

The National Forest Management Act of 1976 directs the Forest Service to establish research natural areas typifying important forest, shrubland, grassland, alpine, and aquatic ecosystems. In addition to their value as reference areas for research and monitoring, research natural areas help maintain biological diversity by conserving assemblages of common and rare species, plant communities relatively undisturbed by human actions, and unique landscape features. The 1983 Northern Region Guide (USDA Forest Service 1983) included a matrix of habitat types, community types, and aquatic features targeted for inclusion in the Northern Region research natural area system. Major revision of this 1983 Regional Guide for research natural areas was completed in 1996 (Chadde et al 1996), with new targeted plant communities and other features for inclusion in Research natural areas. Many research natural areas have been formally established over the past 30 years, including six on the Forest. No new research natural areas are proposed in the Revised Forest Plan. Target assignments from the 1996 assessment not yet filled on the Flathead are listed in appendix C of the Revised Forest Plan, along with information on future opportunities to fill these assignments.

The six established research natural areas on the Forest are permanently designated for the purpose of conserving biodiversity, conducting non-manipulative research and monitoring, and fostering education. They serve as high quality representative areas of the major forms of vegetative variability found in the forest, and present reference areas for the study of natural ecological processes, including disturbances and climate change. Research natural areas are cooperatively identified and managed with the USDA Forest Service Rocky Mountain Research Station. Table 47 lists the six existing research natural areas on the Forest, with a brief description of each following the table.

Table 47. Established research natural areas (RNAs) on the Forest, their establishment date and acres

RNA name	Establishment Date	Acres[a]	Acres[b]
Coram	1988	876	839
East Shore	1991	654	646
Le Beau	1997	5,397	5709
Little Bitterroot	1991	202	200

RNA name	Establishment Date	Acres[a]	Acres[b]
Swan River	1997	692	682
Tuchuck	1991	2,050	2062
	Total Acres =	9,871	10138

a. Acres are from Flathead National Forest GIS data sets.
b. The official acres from research natural area establishment record.

Coram research natural area

Coram research natural area, located in the southeast corner of the Coram Experimental Forest, is situated about three miles east of the town of Hungry Horse, on the Hungry Horse-Glacier View Ranger District. It is part of and located within the boundaries of the Coram Experimental Forest. The research natural area was recognized in 1937 as a natural area but official establishment as a research natural area did not occur until 1988. Since 1937, it has been used extensively for research and educational purposes. Late-successional western larch and interior Douglas-fir stands characterize the area, and it is used as a reference site for comparison to managed areas. Baseline monitoring plots were established in the research natural area in 1985, with additional plots added in 1993. Re-measurement of plots has occurred in 1990 and 2000.

East Shore research natural area

East Shore research natural area is located in the Crane Mountain area on the Swan Lake Ranger District. It lies approximately three miles south of the town of Bigfork, on the slopes above the east shore of Flathead Lake. The research natural area borders private land to the southwest. The research natural area primarily features transition vegetation types ranging from aquatic and moist sites to dry sites within the Douglas-fir, grand fir and western redcedar habitat type series. It was established primarily to preserve in an undisturbed (by humans) condition the terrestrial and aquatic features of the research natural area.

LeBeau research natural area

The LeBeau research natural area lies within Le Beau Creek in the Stillwater River drainage, approximately 18 miles northwest of Whitefish. Most of the research natural area (5,397 acres) occurs on the Tally Lake Ranger District of the Flathead National Forest, with about 400 acres occurring on the adjacent Fortine Ranger District of the Kootenai National Forest. The area possesses a high diversity of montane and subalpine vegetation features (both terrestrial and wetland) and geologic landforms created by continental glaciation. Western redcedar, western hemlock, grand fir, larch and herbaceous plant communities occur on glacier-formed rockland, lake, ponds, and wetlands. The portion of LeBeau Creek that lies within the LeBeau research natural area is proposed in the revised forest plan as an Eligible Wild and Scenic River (see Wild and Scenic River section of this environmental impact statement).

Little Bitterroot research natural area

Little Bitterroot research natural area is located on the far southwestern edge of the Flathead Forest administrative boundary, in the Swan Lake Ranger District. It lies southwest of Marion, about two miles south of Highway 2 along the Little Bitterroot River, which flows north into Little Bitterroot Lake. The Little Bitterroot research natural area lands used to be administered by the Bureau of Land Management until 1966, when it came under the administration of the Forest. The area is completely surrounded by non-NFS lands. This research natural area is characterized by a narrow, steep-walled canyon, with two narrow lakes at the base of the cliffs. Below the lakes are shrub-dominated riparian areas. Nearly all of the forested area of the research natural area is within the dry

Douglas-fir/pine grass habitat type and includes examples of all four habitat type phases defined by Pfister et al. (1977).

Swan River research natural area

Swan River research natural area is located along the Swan River south of Swan Lake, in the Porcupine Creek area of the Swan Lake Ranger District. The research natural area features upland forests dominated by old western larch. Mature western redcedar, grand fir, western white pine, and Douglas-fir are also present. Wetland communities dominated by western redcedar, spruce, black cottonwood, and various shrub and herbaceous species occupy riparian sites such as wet meadows, fens, river edges, and beaver ponds. This research natural area is also within the Swan River Island inventoried roadless area.

Tuchuck research natural area

Tuchuck research natural area lies in Tuchuck Creek, a tributary of Trail Creek which flows into the North Fork Flathead River. The research natural area lies approximately 4 miles south of the U.S./Canadian border on the Hungry Horse-Glacier View Ranger District. Upper elevation and alpine plant communities dominate. Extensive stands of whitebark pine occur, as well as alpine larch and subalpine fir. The entire area burned in 1929 and, as a result, upper slopes are open and dominated by shrubs and herbaceous species, and only slowly advancing into a forest type. Several wet meadows and talus slopes are also present. The area has some of the healthiest whitebark pine stands on the Forest, with lower levels of mortality than observed in most other whitebark pine stands across the forest. The Tuchuck research natural area lies within a recommended wilderness area (MA 1b) in alternatives B and C to the existing forest plan.

Coram Experimental Forest

The Forest contains the Coram Experimental Forest, an approximately 7,500 acre area located on the Hungry Horse Ranger District, established in 1933. Management of the Coram Experimental Forest is the responsibility of the Rocky Mountain Research Station.

The original purpose of the Coram Experimental Forest was to study the ecology and silviculture of western larch as it occurs in a mix with other commonly associated species. Western larch research was centered at Coram Experimental Forest to provide a scientific basis to regenerate and grow this ecologically important and economically valuable species. Long-term studies of soils, forest productivity, stand structure and growth, wildlife habitat and other ecological components following timber harvest activities have been conducted. Climate and hydrological stations record variability in long-term weather and stream flow. Coram Experimental Forest also offers extensive educational opportunities, including the award-winning ‘Walk with Larch Trail’ that demonstrates the long-term effects of silvicultural choices. At the Hungry Horse Ranger District compound, the International Larix Arboretum, also established and managed by the Rocky Mountain Research Station, contains specimens of larch species from around the world. In addition, part of the Coram Experimental Forest is designated as a research natural area (see Table 40 and discussion under research natural areas above).

Miller Creek Demonstration Forest

The approximately 4,900 acre Miller Creek Demonstration Forest is located on the Tally Lake Ranger District, and was set aside in 1989 by the Supervisor of the Forest. Research in this area began in 1966 to study the effect of prescribed fire and silvicultural treatments on regeneration and other conditions within the mixed conifer forests typical of the area. The Miller Creek Demonstration Forest was established to encourage continuing research and to recognize the value

of the area for long-term educational and demonstration purposes. Its management is the responsibility of the Forest.

3.19.6 Environmental consequences

Alternative A – no action

The existing Forest Plan contains management direction for the six established research natural areas and the Coram Experimental Forest. Five of the six research natural areas are designated MA 3a in the existing plan, as amended (amendment 22). Coram research natural area is not a separate MA, but is included within the Coram Experimental Forest, which is designated MA 14. All research natural areas are directed to be managed to perpetuate natural ecosystems and encourage scientific research, with minimum human interference. Each research natural area is managed in accordance with the establishment records and management plan, if available. Management is the responsibility of the Flathead National Forest in cooperation with Rocky Mountain Research Station.

The Coram Experimental Forest is designated MA 14 in the existing 1986 Forest Plan. The Rocky Mountain Research Station manages the experimental forest, coordinating with the Forest through a Memorandum of Understanding. Management emphasizes studies and research to provide ecological and silvicultural information needed to manage western larch-mixed conifer forests.

Miller Creek Demonstration Forest is not specifically identified as a MA within the existing 1986 Forest Plan, and there is no specific direction in the current plan related to the Miller Creek Demonstration Forest. The majority (88 percent) of the area is designated as MA 15, forestlands where timber management with roads is economical and feasible. The remaining area is designated MA 12 (8 percent) and MA 17 (4 percent), which are riparian buffer areas along the perennial streams. The main difference between MA 12 and MA 17 is that timber production is considered unsuitable in MA 12 and suitable in MA 17. Overall management direction is guided by the existing MAs and the management plan specifically prepared for the Miller Creek Demonstration Forest when it was administratively designated in 1988.

Alternatives B, C and D

All six established research natural areas, the Coram Experimental Forest and the Miller Creek Demonstration Forest are retained as currently mapped. Research natural areas are designated as MA 4a, and the Coram Experimental Forest and Miller Creek Demonstration Forest are designated as MA 4b under all action alternatives. Management direction for the research natural areas and the Coram Experimental Forest is the same as in the existing plan, as described under alternative A, and there is no notable difference in potential effects, which is the protection of the values associated with the research natural areas and Coram Experimental Forest, and continuation of the ecological and educational/research purposes of these areas.

In contrast to the existing plan, the Miller Creek Demonstration Forest is designated as an MA (MA 4b) under all action alternatives, with guidance and direction for its management. This direction includes recognition of the area as a demonstration and study area for researchers, educators, forest managers, and the public. It is expected that vegetation management activities would have a dominant role in affecting the condition of the forest, and the Miller Creek Demonstration Forest is considered suitable for timber production. Wheeled motorized travel on designated roads and trails is allowable, as is over-snow vehicle use throughout the area. Riparian habitat conservation areas are identified as occurring along the streams within the Miller Creek Demonstration Forest, and

would be managed and protected in accordance with the direction in the Revised Forest Plan. All action alternatives have a beneficial effect on the Miller Creek Demonstration Forest with the greater recognition of the role this area plays in education and research, and retaining opportunities for management of the forests in this area.

Consequences to research natural areas, Coram Experimental Forest and Miller Creek Demonstration Forest from forest plan components associated with other resource programs or revision topics

Effects from access and recreation

Non-motorized travel and recreational use is allowed within research natural areas and Coram Experimental Forest with limited motorized travel to meet administrative, research and educational objectives. This use is expected to cause minimal to no impact to the values associated with the research natural areas and the Coram Experimental Forest.

Summer motorized travel is allowed on designated routes within the Research natural areas, Coram Experimental Forest and Miller Creek Demonstration Forest. Over-snow winter motorized use is suitable on specific routes and areas as identified on the over-snow vehicle use maps for the Forest. These uses are not expected to impact the values associated with these areas under any of the alternatives.

Effects from vegetation management

Research natural areas and the Coram Experimental Forest are unsuitable for timber production in all alternatives. Vegetation management activities may occur as guided and restricted by regulation and policy. These measures are expected to protect all qualities associated with these areas, and to achieve desired conditions.

Within Research natural areas, the Research Station Director, with the concurrence of the Forest Supervisor, may authorize management practices that are necessary for invasive weed control or to preserve the vegetation for which the Research Natural Area was created (Forest Service Manual 4063.3). As stated in the Manual, limited use of vegetation management may occur within Research natural areas, in situations where the vegetative type would be lost or degraded without management. The criterion is that management practices must provide a closer approximation of the naturally occurring vegetation and the natural processes governing the vegetation than would be possible without management. These practices may include prescribed burning.

Vegetation management, including timber harvest, may occur within the Coram Experimental Forest if needed for study or research purposes. Timber harvesting for other purposes (i.e., fuel reduction, salvage) may also occur but must be coordinated and agreed upon with the Rocky Mountain Research Station.

The Miller Creek Demonstration Forest is suitable for timber production under all alternatives and is expected to have active and regularly scheduled timber harvest in the future under all alternatives. Forest plan components guiding vegetation management would be applied to achieve desired vegetation conditions.

Effects from fire and fire management

Desired conditions for research natural areas in the revised forest plan state that these lands are generally natural appearing, with natural processes (including fire) functioning naturally with limited human influences. One of the purposes for research natural areas is to serve as baseline

areas for the study of these processes and their effects on ecosystems. Management of unplanned ignitions (wildfire) in or near research natural areas would be guided by these forest plan components as well as by the direction provided in each individual research natural area establishment record, Forest Service manual and other regulatory documents, and in consultation with Rocky Mountain Research Station scientists. If the values associated with the research natural area are at risk of degradation or loss due to fire, fire management strategies would likely include measures aimed at protecting those values, if possible. On the other hand, fire as a natural process may be desired and allowed to occur within a research natural area to perpetuate the natural functioning of the ecosystem. In either case, the effects from fire and fire management strategies are expected to have a positive effect on the condition and perpetuation of the ecological and recreational values associated with the Research natural areas.

3.19.7 Cumulative effects

The existing vegetation conditions within the designated areas reflect the contributions of past management actions and ecological processes. Management activities are very limited within Research natural areas, restricted to only that which is needed to maintain features for which the research natural area was established. Management activities will generally continue to take place outside of the existing and proposed Research natural areas, and it is unlikely that these activities would have an effect on the Research natural areas. Control of invasive weeds is an action that may have occurred in the past within Research natural areas, and it is the most likely management activity to occur within research natural areas in the future, in coordination with Rocky Mountain Research Station. This would have a positive effect through the control of invasive weeds or preventing their spread, and would not result in any change to designated Research natural areas.

Vegetation treatments and other activities are likely to continue in the future within the Coram Experimental Forest, as guided by the Rocky Mountain Research Station and plan direction. They are not likely to result in any change to the Coram Experimental Forest designation.

Management activities are likely to occur within the Miller Creek Demonstration Forest in the future, as guided by plan direction. Activities are not likely to result in any change to the designation of the area as Miller Creek Demonstration Forest.

Production of Natural Resources

This section includes the following resources:

- Forest products: Timber
- Other forest products, including huckleberries
- Renewable and non-renewable energy and minerals
- Livestock grazing

3.20 Forest Products: Timber

The Forest contains valuable timber resources. They are important for products that are in demand by the American public, including lumber, house logs, pulpwood, posts and poles, and firewood. Because of the value of the timber resource, commercial timber harvest is used to move vegetation towards their desired conditions, improve watershed condition, improve wildlife habitat, and reduce wildfire risk through reduced fuel loads. Timber harvest also provides jobs and income in logging and manufacturing of wood products.

3.20.1 Legal and administrative framework

Law and executive orders

Federal law

The Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act (NFMA) of 1976: These acts set forth the requirements for Land and Resource Management Plans for the National Forest Service.

The Multiple-Use Sustained Yield Act of 1960: "It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed and wildlife, and fish purposes…The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple-use and sustained yield of several products and services obtained there from…the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

Organic Administration Act of 1897: Forests are established "to improve and protect the Forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States."

Other regulation, policy, and guidance

2012 Planning Rule Procedures: The procedures of the 2012 NFS Land and Resource Management Planning Rule require the identification of areas suitable for timber production and the amount of timber which can be removed annually on a sustained-yield basis. In addition, the procedures require the analysis of the supply and demand situation for resource commodities.

Forest Service Handbook 1909.12, chapter 60: The procedures for identification of lands as not suitable and suitable for timber production and methods for determining the sustained yield limit,

the projected wood sale quantity, and the projected timber sale quantity are described in this handbook.

3.20.2 Key indicators

Key indicators that will be used to measure effects of alternatives are:

- Acres suitable for timber production
- Projected Wood Sale Quantity
- Projected Timber Sale Quantity
- Sustained yield limit.

3.20.3 Methodology and analysis process

Timber suitability was determined using various resource data and GIS to apply criteria and identify lands suitable for timber production. Criteria for suitability are defined in the 2012 Planning Rule procedures at 36 CFR 219.11 and Forest Service Handbook 1909.12, chapter 60. Data was developed using the latest data sources and requirements to match the criteria defined by resource specialists.

Timber demand is based on a capacity and capability analysis completed by the University of Montana's Bureau of Business and Economic Research (Sorenson et al. 2012).

Timber harvest was modeled using SPECTRUM, a software modeling system designed to assist decision makers in exploring and evaluating multiple resource management choices and objectives. Models constructed with SPECTRUM apply management actions to landscapes through a time horizon and display resulting outcomes. Management actions are selected to achieve desired goals while complying with all identified management objectives. One of the goals for all action alternatives was the objective to move vegetation towards desired condition. Other goals that were applied for some alternatives included maximizing timber output and present net value. The SPECTRUM model was used to determine the sustained yield limit and the projected timber sale quantity and acres treated by decade for each alternative. Historic data, along with the projected timber sale quantity, was used in determining the projected wood sale quantity for each alternative.

Information sources

Data used in determining timber suitability, projected wood sale quantity, and projected timber sale quantity is described in appendix 2.

Incomplete and unavailable information

There is no incomplete or unavailable information for this analysis. However, it should be noted this analysis was completed at the strategic level, using forest level data sources. Site-specific data at the project scale is expected to result in some changes to timber suitability.

The SPECTRUM model is a simulation and a predictor of projected timber sale quantity and acres treated. It is used to display tradeoffs between alternatives and to predict sustainable timber harvest levels over time. The actual timber harvest level is dependent on many variables, including budget, spatial limitations on the ground, and demand for products.

Analysis area

The analysis area for timber suitability is comprised of the NFS lands administered by the Flathead National Forest. The analysis area for timber demand consists of nine counties comprising the timber processing area. The analysis area for the projected timber sale quantity is the lands suitable for timber production and lands where timber harvest may occur. The analysis area for the projected wood sale quantity is the lands suitable for timber production and lands where timber harvest or firewood collection may occur.

3.20.4 Affected environment (existing condition)

Timber suitability

Lands suitable for timber production were used to derive the allowable sale quantity (ASQ) for the current plan. The 1986 Forest Plan determined 670,670 acres to be suitable for timber production. Timber suitability was determined through the use of resource data and computer models and followed the handbook and planning regulations that were in place at the time.

There have been many changes to timber suitability as the Plan has been amended and implemented over the past three decades. These changes include reductions in lands suitable for timber production in riparian areas and inventoried roadless areas. There have also been changes in data and land status, resulting in updated figures for timber suitability. As part of the forest plan revision, timber suitability was re-calculated to reflect these changes in management and data. Table 48 displays timber suitability at the time the 1986 forest plan was adopted and under the no-action alternative (1986 forest plan as amended and implemented).

Table 48 Timber suitability for the 1986 Plan

Suitability Category	1986 Plan - as Written	No-action alternative (1986 forest plan - as amended)
Total NFS Lands	2,362,082	2,392,804
Non-Forest Land (1)	-1,006,594	-117,200
Withdrawn Lands (2)	-519,741	-1,371,717
Irreversible Resource Damage is likely or Adequate Restocking not assured (3)	0	-166,508
Lands Tentatively Suitable for Timber Production	835,747	737,379
Lands where MA prescriptions preclude timber production, where management requirements cannot be met, or not cost efficient in meeting timber production objectives. (4)	-165,077	-210,406
Lands Suitable for Timber Production	670,670	526,973

(1)-Handbook direction at the time the 1986 Plan was developed had lands that were not productive (producing <20 cubic feet/acre/year) classified as “non-forested.” The 2012 planning rule procedure does not consider low productive lands as non-forested. Because of this change in definition and updated data, the total forested NFS lands have increased from the 1986 Plan.

(2)-Change in the amount of withdrawn lands is mostly due to a change in the order of subtraction plus the addition of inventoried roadless area (460,791 acres) which are no longer suitable for timber production under the 2001 Roadless Area Conservation Rule.

(3)-The difference between irreversible damage and adequate restocking is mostly due to better data than was available for the 1986 Forest Plan.

(4)-The difference includes identification of RMZs as not suitable for timber production

Under the no action alternative, 445,432 acres are suitable for timber harvest that are not suitable for timber production. A large portion of this acreage is comprised of inventoried roadless areas (approximately 320,773 acres) that are allocated to MAs where timber harvest is allowed to meet desired conditions. In these areas, timber harvest may be used as a tool under the following specific set of circumstances: the cutting, sale, or removal of generally small diameter timber is needed to improve threatened and endangered, proposed or sensitive species habitat or to maintain or restore the characteristics of ecosystem composition and structure that would be expected to occur under natural disturbance regimes. Refer to figure 1-07 (appendix 1) for map showing lands suitable for timber production under alternative A.

Timber demand

Timber demand was analyzed as part of the 1986 Forest Plan. Timber from the Flathead National Forest has historically been processed primarily in Flathead County, with smaller percentages utilized by mills in Missoula and Lake Counties. In 1976, the production capacity of zone of influence sawmills that produced at least 10 mmbf per year was determined to be 687 mmbf with about 322 mmbf of that capacity located in Flathead County. This was updated in 1981 and estimated at 650 mmbf with 291 mmbf in Flathead County. The percent of this supplied by the Flathead National Forest varies by county. In 1976, about 65 percent of the timber received in Flathead County was from NFS lands. In Missoula and Lake Counties, only 18 percent of sawtimber was of National Forest origin in 1976 (Flathead National Forest Plan environmental impact statement, page III-31).

Timber demand was updated in 2012 using a capacity and capability analysis for the Forest. This analysis was conducted by the University of Montana's Bureau of Business and Economic Research, resulting in a report prepared for the Flathead National Forest (Sorenson et al. 2012). The term "capacity" refers to the volume of timber (excluding pulpwood) that existing mills could utilize annually. The term "capability" refers to the volume of trees of a certain size class that existing mills can efficiently process annually. The following information on timber demand is excerpted from this report.

Flathead National Forest non-reserved timberland is located in three Montana counties: Flathead, Lake, and Missoula. The total harvest form all lands in these three counties was 43.9 million cubic feet (mmcf) in 2009. Fifteen percent (6.6 mmcf) of the timber harvest in this three-county area originated from the Flathead National Forest. Most (80 percent) of the timber harvested from these counties consisted of green (live) trees. Sawmills and veneer/plywood plants received about 71 percent of the timber harvested from these counties. House logs, posts and small poles, and other mills received less than 2 percent of the timber harvest volume. Pulp and paper mills utilized 28 percent of the 2009 harvest from the three-county region.

The 2011 harvest in the three-county area was estimated to be approximately 51.4 mmcf. Given the mill closures that have occurred in the region since 2009, the pulpwood component was close to the historical average of 5 percent of the total harvest in 2011. The Flathead National Forest harvest in the three-county area was estimated to be approximately 10 percent of the total harvest by all ownerships.

In addition to the three counties with Flathead National Forest non-reserved timberland, another six counties process the majority of timber coming off of the forest. The Flathead National Forest timber processing area was determined by the Bureau of Business and Economic Research to be the nine-county area including Flathead, Jefferson, Lake, Lewis and Clark, Lincoln, Mineral, Missoula, Ravalli, and Sanders Counties in Montana.

Capacity to process timber in the Flathead National Forest timber processing area during 2011 was 112 mmcf, with mills utilizing approximately 56 mmcf or about 50 percent of capacity (see table 49). Nearly 89 percent (49.9 mmcf) of the volume processed in the timber processing area was composed of trees with diameter at breast height (d.b.h.) ≥ 10 inches. Just over 7 percent (4.1 mmcf) of the volume processed came from trees 7.0 – 9.9 inches d.b.h., while approximately 4 percent (2.2 mmcf) of processed volume came from trees < 7 inches d.b.h..

Table 49. Annual volume of timber processed by tree size class (excluding pulpwood) for the Flathead National Forest timber processing area, 2011.

Tree d.b.h.	Volume Used (mmcf timber)	Tree d.b.h.	Volume Used (mmbf scribner)
< 7 in.	2,196	< 7 in.	2,196
7 - 9.9 in.	4,106	7 - 9.9 in.	15,768
10+ in.	49,946	10+ in.	236,154
Total	**56,248**	**Total**	**254,118**

About 59 percent (66.5 mmcf) of the 112 mmcf of existing capacity in the Flathead National Forest timber processing area is not capable of efficiently utilizing trees < 10 inches d.b.h., and nearly 60 percent of the capacity capable of utilizing trees < 10 inches d.b.h. is in the 7 – 9.9 inches d.b.h. class (see Table 50).

Table 50. Annual total capacity and capability* to process trees by size class (excluding pulpwood) for the Forest timber processing area, 2011.

Tree d.b.h.	Capability (mmcf timber)	Tree d.b.h.	Capability (mmbf scribner)
< 7 in.	18,251	< 7 in.	18,251
7 - 9.9 in.	27,175	7 - 9.9 in.	104,351
10+ in.	66,468	10+ in.	371,003
Total Capacity	**111,893**	**Total Capacity**	**493,606**

* Note: Capability in < 7 and 7 – 9.9 inch classes is maximum volume capable of being used efficiently; capability in 10+ inch class is portion of total capacity NOT capable of efficiently using trees with d.b.h. < 10 inches

A substantial amount of the capacity capable of utilizing smaller diameter trees is being used to process larger trees or going unused. About 12 percent of capacity in the < 7 inches d.b.h. category is currently utilized to process trees < 7 inches d.b.h., and slightly more than 15 percent of capacity in the 7 – 9.9 inches d.b.h. category is being used to process trees 7 – 9.9 inches d.b.h.. More than 7.6 mmcf of capacity capable of using trees 7 – 9.9 inches d.b.h. is used annually to process trees ≥ 10 inches d.b.h. Recent (2007–2011) poor market conditions for lumber have reduced mill demand for smaller diameter logs used to make studs. When markets are poor it becomes more difficult to profitably produce lumber from small and low quality logs. The price of stud grade lumber, which is predominantly made from small logs, fell by a much higher percentage during the recent recession than many other dimensions and board and shop lumber grades (Random Lengths 2010). This reduced the profitability of sawing lower grades of lumber from small and lower quality logs. As lumber markets recover, increased capacity utilization can be expected across all the size classes.

Timber supply

Before the Flathead National Forest was established, timber was harvested on the Forest to meet the needs of the people living in the area. Like many other national forests, timber harvest on the Forest greatly increased in the 1960s to meet the demands of a rapidly growing economy.

Figure 3 displays the total volume of timber cut and sold on the Flathead National Forest during the life of the current plan, from 1986 to 2012. The amount cut is based on the amount sold by the Forest Service. The amount and timing of harvest from the volume under contract with the Forest Service is in response to market conditions and demand for timber products. The largest volume harvested during this time was in 1988 when nearly 122 mmbf of timber was harvested on the Forest. The largest volume sold occurred two years earlier (1986) when more than 87 mmbf of timber was sold. However, the decade of the 1990s saw a sharp decline in the volume harvested and sold, with the lowest volumes occurring at the beginning of the century. In 2001, only 6 mmbf of timber was harvested on the Flathead National Forest and the lowest sold volume (4.5 mmbf) occurred in 2000. In 2012, 28 mmbf of timber was harvested on the Flathead National Forest and 20.3 mmbf was sold.

The 1986 forest plan allowable sale quantity (ASQ) is 54 mmbf average annual timber harvest. The ASQ is the maximum level of harvest consistent with the 1986 forest plan's standards and guidelines. The annual timber volume offered per year averaged 36 mmbf over the period 2000 through 2010. This actual amount of timber offered is influenced by a variety of factors, including site-specific environmental analyses, public involvement on project proposals, choice of harvest methods, and effects of administrative appeals and litigation[7] (Morgan and Baldridge 2015). In addition, actual levels are limited by the budget the Forest receives for that purpose, and workforce capacity needed to prepare sales and the associated environmental analyses. Forest Service funding and workforce capacity to support the timber sale program is not expected to increase in the immediate future.

Actual timber volume offered is also influenced by factors outside the authority of the Forest Service. For example, forest conditions on adjacent non-national forest lands can limit harvesting opportunities on Forest Service lands, in order to provide for wildlife habitat needs. Other regulatory agencies, such as the USFWS, may also provide direction that limits harvest levels to protect threatened and endangered species, meeting their responsibility under the Endangered Species Act.

[7] Litigation has a real impact on the amount of timber that can be sold. A recent study by Morgan and Baldridge (2015) concludes "the relatively high frequency of litigation in Region One and the protracted duration (often one to two years) of litigated cases contributes to agency workload, cost, and uncertainty, as well as uncertainty and related economic impacts for loggers, mills, and communities near the forests. Even if agency personnel were not spending effort working on these cases each day cases were open, the duration of most litigated cases was over multiple planning and budget cycles, making resource management and financial decisions very difficult for the FS, mills, loggers, and forest-dependent communities in the Region." Sales that are litigated are delayed in coming to sale and often require additional analysis as circumstances change over time.

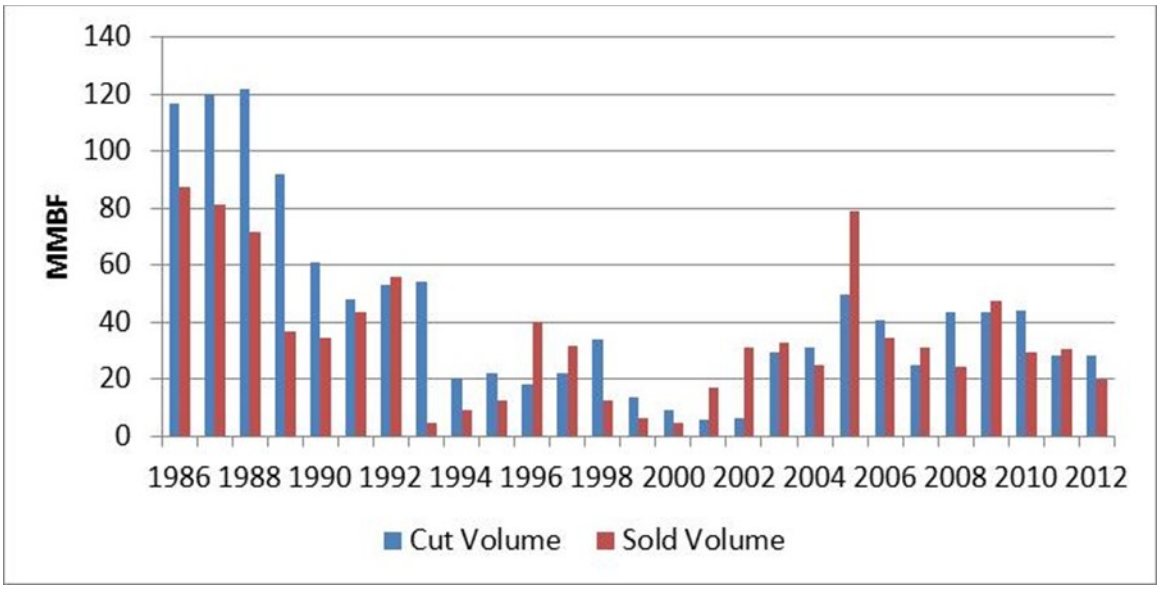


Figure 3. Cut and sold volumes for the Forest: 1986-2012

Actual timber volume offered is also influenced by factors outside the authority of the Forest Service. For example, forest conditions on adjacent non-national forest lands can limit harvesting opportunities on Forest Service lands, in order to provide for wildlife habitat needs. Other regulatory agencies, such as the USFWS, may also provide direction that limits harvest levels to protect threatened and endangered species, meeting their responsibility under the Endangered Species Act.

3.20.5 Environmental consequences

Alternative A – no action

Timber suitability

Under the no action alternative, timber suitability was updated to reflect plan amendments, current data, and current regulation (see earlier discussion on timber suitability for the 1986 Forest Plan). Lands that may be suitable for timber production are consistent for all alternatives and total 737,000 acres (see table 51). These are lands that are physically capable and have not been administratively withdrawn (such as wilderness and inventoried roadless areas) from timber production.

From the lands that may be suitable for timber production, 210,500 acres were found to have other resource concerns that would preclude timber production as an objective. This includes riparian areas, recommended wilderness, and other MAs where timber production would not be consistent with desired conditions.

Timber harvest is allowed on lands not suitable for timber production (see FW-GDL-ECOS TIMB-01), for such purposes as salvage, fuels management, insect and disease mitigation, protection or enhancement of wildlife habitat, to perform research or administrative studies, or for recreation and scenic-resource management. Timber harvest on these lands would have to be consistent with other management direction. Lands where timber harvest may be allowed is defined by MA and desired conditions. Any timber harvest off these lands is not scheduled and would not occur on a rotation

basis. Alternative A has 445,400 acres (19 percent of the Forest) where timber harvest is allowed on land not suitable for timber production.

Projected timber sale quantity and projected wood sale quantity

In order to compare outputs under alternative A to those of the action alternatives, the allowable sale quantity (ASQ) for the 1986 Plan was updated to reflect a projected timber sale quantity (PTSQ) and projected wood sale quantity (PWSQ) following current handbook requirements. These projected sale quantities were formulated by considering the lands suitable for timber production and lands suitable for timber harvest, vegetation desired condition, other multiple-use objectives, and the management requirements set forth in NFMA. Based on 2012 Planning Rule direction (36 CFR 219.1(g)) and Forest Service handbook requirements (Forest Service Handbook 1909.12, 64.32), the projected timber sale quantity and projected wood sale quantity reflect currently foreseeable budget levels. In order to understand sustainable volumes under potentially higher budgets, sale quantities were also estimated without a budget constraint for comparison purposes.

Timber harvest levels were calculated using SPECTRUM (see appendix 2). The model was run with a mix of objective functions, based on the theme of the alternative. To reflect direction under the 1986 Forest Plan, alternative A was run with an objective to maximize timber production.

The projected timber sale quantity for alternative A is 28.2 mmbf/year for the first decade. Without a budget constraint, the sale quantity is 52.4 mmbf/year for the first decade. Modeling indicates that, although a much higher timber harvest level may be possible without a budget constraint, the forest would require more than an additional 3.5 million dollars annually in the first decade to achieve this.

Sustained yield limit

Under alternative A, the long-term sustained-yield limit for the 1986 Plan is replaced with a sustained yield limit. The sustained yield limit is based on the productivity of the land and does not vary by alternative. See discussion below for the action alternatives on the calculation of the sustained yield limit.

Alternatives B, C, and D

Timber suitability

Lands suitable for timber production were determined following direction under the 2012 Planning Rule (36 CFR 219.11(a)) and handbook direction (Forest Service Handbook 1909.12, 61). Lands that may be suitable for timber production are consistent for all alternatives and total 737,000 acres (see Table 51). These are lands that are physically capable and have not been administratively withdrawn (such as wilderness and inventoried roadless areas) from timber production.

Based on MAs and desired conditions, timber suitability then varies by alternative. Lands in MAs 6b and 6c, a portion of MA 7, and the Miller Demonstration Forest (MA 4b) are suitable for timber production. All other MAs preclude timber production as an objective. Timber harvest may be allowed in other MAs (2a and 2b in scenic or recreation segments, 3a, 3b, 4a, 4b – Coram Experimental Forest, 5a, 5b, 5c, 5d, 6a, and part of 7), but only to meet other resource objectives. These acres are not suitable for timber production. Table 51 displays timber suitability for each alternative.

Table 51. Timber suitability by alternative

Land Classification Category	Alt A	Alt B	Alt C	Alt D
A. Total NFS lands in the plan area	2,392,800	2,392,800	2,392,800	2,392,800
B. Lands not suited for timber production due to legal or technical reasons	1,655,400	1,655,400	1,655,400	1,655,400
C. Lands that may be suited for timber production (A−B)	737,400	737,400	737,400	737,400
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan	526,900	499,100	317,300	500,400
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C – D)	210,500	238,300	420,100	237,000
F. Total lands not suited for timber production (B+E)	1,865,900	1,893,700	2,075,500	1,892,400

Alternative A has the most acres suitable for timber production. Acres suitable for timber production are slightly higher in this alternative than found in the action alternatives. This is because the MA allocation for the 1986 forest plan has slightly lower acres of MAs where timber production is not consistent with desired condition. Of the action alternatives, alternative D has the most acres suitable for timber production while alternative C has the least. This is primarily because alternative D has the lowest number and alternative C the greatest number of acres recommended for wilderness. Refer to figure 1-07, and figures B-27, B-28 and B-29 for maps displaying lands suitable for timber production in each alternative.

As the plan is implemented on the ground, timber suitability may change based on site-specific analysis. Broad-scale information is used in determining lands suitable for timber production in the Plan. As a result, changes may occur at the project-scale level using site-specific data. Changes to timber suitability will be monitored during implementation of the plan.

Timber harvest is allowed on lands not suitable for timber production (see FW-GDL-TIMB-01), for such purposes as salvage, fuels management, insect and disease mitigation, protection or enhancement of wildlife habitat, to perform research or administrative studies, or recreation and scenic-resource management. Timber harvest on these lands would have to be consistent with other management direction. Timber harvest on these lands is not scheduled or managed on a rotation basis, but they do contribute towards projected sale quantities described below.

Acres where timber harvest is allowed on land not suitable for timber production are as follows: alternative A = 445,400 acres (19 percent of the Forest); alternative B = 411,800 acres (17 percent of the Forest); alternative C = 392,000 acres (16 percent of the Forest); and alternative D = 508,000 acres (21 percent of the Forest). Under alternatives B and D, approximately one-half of these acres are comprised of inventoried roadless areas. For alternative C, the largest percentage of these acres are those allocated to MA 6a.

Projected sale quantities

The projected sale quantities for each alternative were formulated by considering the lands suitable for timber production, vegetation desired condition, other multiple-use objectives, and the management requirements set forth in the National Forest Management Act. Timber harvest levels for the alternatives were calculated using SPECTRUM (see appendix 2). The model was run with a

mix of objective functions, based on the theme of the alternative. Alternative A was run with an objective to maximize timber production while alternatives B and C had objectives to move towards vegetation desired condition as quickly as possible, while meeting other resource objectives. Alternative D had an objective function to maximize timber and then to move towards vegetation desired condition. Table 52 displays the timber sale quantities for each alternative. Outputs are shown by both million cubic feet (mmcf) and million board feet (mmbf) per year.

Table 52. Average annual projected timber sale quantities by alternative — decades 1 and 2 with reasonably foreseeable budget

Category and Decade	Alt. A (mmcf)	Alt. A (mmbf)	Alt. B (mmcf)	Alt. B (mmbf)	Alt. C (mmcf)	Alt. C (mmbf)	Alt. D (mmcf)	Alt. D (mmbf)
Timber Products[a] A1. Lands suitable for timber production (decade 1)	5.3	25.6	5.2	25.8	3	13.8	5.8	28.6
Timber Products[a] A1. Lands suitable for timber production (decade 2)	5.9	28.4	5.2	24.5	3.7	17.6	5.7	27.6
Timber Products[a] A2. Lands not suitable for timber production (decade 1)	0.5	2.6	0.3	1.6	0.9	4.2	0.1	0.6
Timber Products[a] A2. Lands not suitable for timber production (decade 2)	0	0	0.3	2.7	0.9	4.4	0.2	1
Projected Timber Sale Quantity (PTSQ, A1 + A2) (decade 1)	**5.8**	**28.2**	**5.5**	**27.4**	**3.9**	**18**	**5.9**	**29.2**
PTSQ (A1 + A2) (decade 2)	**5.9**	**28.4**	**5.5**	**27.2**	**4.6**	**22**	**5.9**	**28.6**
Other Wood Products[b] B. All lands (decade 1)	0.8	n/a[c]	0.8	n/a[c]	0.6	n/a[c]	0.9	n/a[c]
Other Wood Products[b] B. All lands (decade 2)	0.8	n/a[c]	0.8	n/a[c]	0.6	n/a[c]	0.9	n/a[c]

Category and Decade	Alt. A (mmcf)	Alt. A (mmbf)	Alt. B (mmcf)	Alt. B (mmbf)	Alt. C (mmcf)	Alt. C (mmbf)	Alt. D (mmcf)	Alt. D (mmbf)
Projected Wood Sale Quantity (PWSQ) – Timber Products[a] and Other Wood Products[b] (A1 + A2 + B) (decade 1)	**6.6**	**n/a[c]**	**6.3**	**n/a[c]**	**4.5**	**n/a[c]**	**6.8**	**n/a[c]**
PWSQ – Timber Products[a] and Other Wood Products[b] (A1 + A2 + B) (decade 2)	**6.7**	**n/a[c]**	**6.3**	**n/a[c]**	**5.2**	**n/a[c]**	**6.8**	**n/a[c]**

a. Timber Products - Volumes other than salvage or sanitation volumes that meet timber product utilization standards.

b. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3 -7 inches).

c. n/a – not applicable

Source: SPECTRUM model analysis

To determine the highest sustainable harvest levels possible, the alternatives were also run without a budget limitation (see appendix 2). Table 53 displays projected sale quantities by alternative that may be possible if there is no requirement to be within reasonable budget limitations. These numbers are not the projected timber sale quantities found in the objectives of the Plan because they do not meet the requirement to be within reasonably foreseeable budgets. They are shown here to display what may be feasible if budgets were increased above what is reasonably foreseeable.

Table 53. Average annual projected timber sale quantities by alternative — decades 1 and 2 with no budget limitation

Category and Decade	Alt. A (mmcf)	Alt. A (mmbf)	Alt. B (mmcf)	Alt. B (mmbf)	Alt. C (mmcf)	Alt. C (mmbf)	Alt. D (mmcf)	Alt. D (mmbf)
Timber Products[a] A1. Lands suitable for timber production (decade 1)	10	48.5	7	34.7	3.5	16.3	10.7	52.4
Timber Products[a] A1. Lands suitable for timber production (decade 2)	12.3	60	7.5	36.9	3.5	11.5	11.6	56.5
Timber Products[a] A2. Lands not suitable for timber production (decade 1)	0.8	3.9	0.7	3.7	0.4	1.7	2.3	11.1
Timber Products[a] A2. Lands not suitable for timber production (decade 2)	0.03	0.1	0.4	1.7	0.4	6.6	1.4	6.6
Projected Timber Sale Quantity (PTSQ, A1 + A2) (decade 1)	**10.8**	**52.4**	**7.7**	**38.4**	**3.9**	**18**	**13**	**63.5**
PTSQ (A1 + A2) (decade 2)	**12.33**	**60.1**	**7.9**	**38.6**	**3.9**	**18.1**	**13**	**63.1**

Category and Decade	Alt. A (mmcf)	Alt. A (mmbf)	Alt. B (mmcf)	Alt. B (mmbf)	Alt. C (mmcf)	Alt. C (mmbf)	Alt. D (mmcf)	Alt. D (mmbf)
Other Wood Products[b] B. All lands (decade 1)	1.5	n/a[c]	1	n/a[c]	0.6	n/a[c]	1.6	n/a[c]
Other Wood Products[b] B. All lands (decade 2)	1.5	n/a[c]	1	n/a[c]	0.6	n/a[c]	1.6	n/a[c]
Projected Wood Sale Quantity (PWSQ) – Timber Products[a] **and Other Wood Products**[b] **(A1 + A2 + B) (decade 1)**	**12.3**	**n/a[c]**	**8.7**	**n/a[c]**	**4.5**	**n/a[c]**	**14.6**	**n/a[c]**
PWSQ – Timber Products[a] **and Other Wood Products**[b] **(A1 + A2 + B) (decade 2)**	**13.83**	**n/a[c]**	**8.9**	**n/a[c]**	**4.5**	**n/a[c]**	**14.6**	**n/a[c]**

a. Timber Products - Volumes other than salvage or sanitation volumes that meet timber product utilization standards.
b. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3 -7 inches).
c. n/a – not applicable
Source: SPECTRUM model analysis

Budget levels would have to greatly increase to achieve the timber sale quantities shown in table 53. Budgets would need to increase by more than 3.5 million dollars per year under alternative A, by more than 1.5 million dollars under alternative B, and by more than 5 million dollars under alternative D to achieve these sale levels. Because of low timber harvest levels, alternative C does not require the entire current budget level; rather, it is 2.2 million dollars below current levels. With no budget limitation, under alternative C there is no increase in the budget for the first several decades. Budget levels and activities eventually increase in response to trending towards desired conditions.

The effects on timber production are directly related to the amount of acres classified as suitable for timber production. The amount of timber production is also directly related to the objective the model was run under based on the theme of the alternative. Because of this, alternative D has the highest and alternative C the lowest timber sale quantities.

Table 54 and table 55 display the acres harvested in decades one and two to achieve the volumes shown, correspondingly, in table 52 and table 53. Acres harvested are a mix of silvicultural prescriptions, including even-aged regeneration (clearcut, seedtree, shelterwood) and non-regeneration harvest (group selection or commercial thin). Under reasonably foreseeable budget levels, alternative B has the most even-aged regeneration harvest acres in achieving the timber sale quantities and alternative C the least. At the reasonably foreseeable budget level, alternative C has the most non-regeneration harvest acres to move vegetation towards desired condition. At the reasonably foreseeable budget level, alternatives A and D harvest fewer acres than alternative B, but in a more efficient manner to maximize volume. At the unlimited budget level, alternative D harvests the most acres.

Table 54. Average annual acres treated by treatment type by alternative — decades 1 and 2 – reasonably foreseeable budget

Type and Decade of Harvest	Alternative A	Alternative B	Alternative C	Alternative D
Even-aged Regen (decade 1)	1,199	1,845	77	1,833
Even-aged Regen (decade 2)	1,081	1,942	411	908
Non-Regen (decade 1)	-	1,000	2,500	-
Non-Regen (decade 2)	-	860	2,827	1,500
Total (decade 1)	**1,699**	**2,845**	**2,577**	**1,833**
Total (decade 2)	**1,581**	**2,802**	**3,238**	**2,408**

Table 55. Average annual acres treated by treatment type by alternative — decades 1 and 2 –unlimited budget

Type and Decade of Harvest	Alternative A	Alternative B	Alternative C	Alternative D
Even-aged Regen (decade 1)	2,459	2,991	49	3,201
Even-aged Regen (decade 2)	2,694	2,265	185	2,771
Non-Regen (decade 1)	1,500	1,002	2,500	1,500
Non-Regen (decade 2)	1,500	1,000	2,500	1,500
Total (decade 1)	**3,959**	**3,993**	**2,549**	**4,701**
Total (decade 2)	**4,194**	**3,265**	**2,685**	**4,271**

Sustained yield limit

A sustained yield limit was calculated to determine the amount of timber "which can be removed from [a] forest annually in perpetuity on a sustained-yield basis" (NFMA at section 11, 16 USC 1611; 36 CFR 219.11(d)(6)). Based on Forest Service handbook direction (Forest Service Handbook 1909.12, 64.3), the sustained yield limit is the volume that could be produced in perpetuity on lands that may be suitable for timber production. The calculation of the sustained yield limit is not limited by land management plan desired conditions, other plan components, or the Forest's fiscal capability and organizational capacity. The sustained yield limit is not a target but is a limitation on harvest. Because it is based on lands that may be suitable for timber production, the sustained yield limit does not vary by alternative. The sustained yield limit was calculated using SPECTRUM and determined to be 25.4 mmcf, or 116.9 mmbf.

Consequences to timber from forest plan components associated with other resource programs or revision topic

Effects from fire and fuels

Fire and fuels management generally has a positive effect on timber management. The objectives for fuel reduction are consistent with commercial timber harvest. Timber harvest is often the tool for reducing fire risk through a reduction in fuel loading. Timber harvest also moves vegetation towards desired conditions that are more resilient and less fire-prone. Alternative B has the most management activities for fire and the most positive impact on timber harvest.

Effects from aquatic habitat, riparian, watershed, and wildlife

Measures to protect aquatic habitat, riparian areas, watersheds, and wildlife limit the amount of timber that may be harvested. Riparian areas are not suitable for timber production. This reduces the amount of land available for scheduled timber harvest. Protection measures for watersheds, aquatic habitat, and wildlife limit the amount of openings and the type of harvest. All of these factors reduce the amount of timber harvest. The reduction in timber harvest is the same for all alternatives.

Effects from grizzly bear

Management for grizzly bears limits timber harvest under all alternatives. However, under alternatives B and D, there would be increased flexibility to conduct timber harvest within grizzly bear habitat in the NCDE than exists under alternative A (see FW-STD-IFS-04). Alternative C increases the area covered by forest plan components for grizzly bear management, but retains the flexibility found in alternatives B and D. Alternative A would continue management under amendment 19, with some future road closures and reduced flexibility for timber harvest.

Effects from inventoried roadless areas

Inventoried roadless areas are not suitable for timber production. Based on the MA allocation, timber harvest may be allowed in some inventoried roadless areas. The amount of inventoried roadless areas that are allocated to MAs suitable for timber harvest varies by alternative. Table 56 and table 57 display acres where timber harvest may be allowed within inventoried roadless areas for each alternative, with a reasonably foreseeable budget and no budget limitations, respectively. The tables also show the acres of inventoried roadless areas that are allocated to harvest sometime over the modeling horizon (250 years) and the amount of timber harvest from these areas in the first decade.

Table 56. Acres suitable for timber production, percent scheduled for harvest, and first decade harvest within inventoried roadless areas, with reasonably foreseeable budget

Alternative	Acres Timber Harvest May be Allowed in IRA	Percent Allocated to Harvest (over 250 years)	Timber Harvest from IRA Decade 1 (mmbf/yr)
A	233,200	2%	0
B	186,500	4%	1.5
C	6,700	3%	0
D	271,100	3%	0

Table 57. Acres suitable for timber production, percent scheduled for harvest, and first decade harvest within inventoried roadless areas, with unlimited budget

Alternative	Acres Timber Harvest May be Allowed in IRA	Percent Allocated to Harvest (over 250 years)	Timber Harvest from IRA Decade 1 (mmbf/yr)
A	233,200	21%	4.6
B	186,500	7%	0.9
C	6,700	2%	0
D	271,100	5%	3.1

Timber harvest within inventoried roadless areas is limited, requires additional analysis, and receives a great deal of public and agency scrutiny. Because of limited access and the additional analysis and public/agency involvement, unit costs for timber harvest are much higher within an inventoried roadless area. No alternative manages all inventoried roadless area acres for timber harvest, with fewer acres managed under constrained budgets. Alternative C has the fewest acres of inventoried roadless area where timber harvest may be allowed, with no timber volume generated from these lands. Alternative D has the most acres of inventoried roadless area where timber harvest may be allowed, with a larger percentage of those lands managed for timber harvest under the unconstrained budget run. However, management opportunities are expected to continue to be limited within inventoried roadless areas and harvest within these areas may be infeasible.

Effects from recommended wilderness management

Alternative C has the greatest acres of recommended wilderness and represents the maximum amount of area that could potentially be designated as recommended wilderness (MA 1b). Comparing the recommended wilderness areas in alternative C to the lands suitable for timber production in alternatives B and D indicates that recommended wilderness designation has little to no impact on potential timber outputs from the suitable land base. This is because there are no acres under alternative B and only 5,200 acres under alternative D within the suitable timber base that would occur within areas that qualify as recommended wilderness, as reflected by alternative C which has the greatest acres of recommended wilderness. The 5,200 acres in alternative D represents about 1 percent of all the suitable acres within alternative D, and are small patches and strips of lands widely scattered across the forest.

Under alternative A, the current forest plan, an estimated 15,000 acres of lands suitable for timber production lie within the recommended wilderness areas of alternative C, however these lands consist of relatively small patches widely scattered across the forest. This represents approximately 3 percent of the 526,973 acres suitable for timber production in alternative A (see table 48). Most (approximately 10,000 acres) are in locations that are not realistically suitable under the current management environment. If these unrealistic acres are removed, alternative A is similar to

alternative D as far as potential effect to timber outputs, with less than 1 percent of the suitable lands potentially affected by recommended wilderness designation.

Effects from natural disturbance

Insects, disease, and wildfire can affect the production of timber by killing and damaging trees. The SPECTRUM model included a predicted amount of wildfire on the Forest based on current fire suppression success and fire starts. See appendix 2 for more information on the SPECTRUM model.

Under all alternatives, there exists potential for salvage/sanitation cuts to harvest dead and damaged timber and to attempt to slow or impede infestations from spreading. The degree to which these harvests are undertaken will largely depend upon the risks associated with wildfire potential, infestation spread into healthy stands, public safety, the presence of high value resources, and the resource emphasis of the infected or adjoining area. These would all be determined at the site-specific project level of analysis and decision.

Under alternative C, where there are more acres in recommended wilderness compared to alternatives A, B and D. Natural ecosystem processes, including fire and insect activity, would dominate, and harvest activities would be prohibited in recommended wilderness. However, as discussed earlier under Effects from inventoried roadless areas and recommended wilderness, most of the recommended wilderness is within inventoried roadless areas and access and harvest opportunities are already limited, whether these areas are designed as recommended wilderness or as backcountry management areas (refer to discussion above under effects from inventoried roadless areas). Thus there is relatively minor differences between alternatives on the amount of salvage harvest that would be achievable and potentially influence the intensity or impacts of disturbances such as fire or insect outbreaks. There could be a somewhat greater potential for limited amount of salvage harvest, for example in areas accessible to helicopter logging methods, in alternatives A, B and D because of fewer acres of recommended wilderness, which is replaced by backcountry management areas (MA 5 a, b, c or d) that allow salvage harvesting.

Catastrophic events, such as large wildfires and epidemic insect outbreaks, were not included in the modeling because of uncertainty in the extent or timing of such an occurrence. If a catastrophic event does occur in the future, analysis would need to be conducted to determine if the event would warrant a Forest Plan amendment for changed conditions.

3.20.6 Cumulative effects

There are many factors that influence and affect timber harvest. The demand for timber products, supply from other sources, laws, and regulations all affect the amount of timber that may be harvested from the Flathead. Budgets and court decisions also impact timber supply potential. Following is a brief description of some items that are changing or may change in the future, adding to the effects on timber harvest from the alternatives.

Demand and future timber products

The demand for timber products is a driver in the amount of wood fiber supplied from the Flathead. Diversification of wood product manufacturing has historically allowed Montana mills to be more resilient in changing markets (Montana Department of Natural Resources 2010). This diversification leads to new products and new processing techniques, and affects the demand for wood fiber. If markets improve and demand for wood products increases, there will be the desire for more wood fiber from the Flathead. Alternatively, if demand decreases and mills close, there may

be less desire for wood fiber from the Flathead. A decrease in demand may reduce the amount of timber sold from the Flathead under all alternatives.

Alternative sources for wood fiber

The supply of wood fiber from private and state lands and adjacent national forests impacts the Flathead demand. If wood fiber supplies decrease from private and state lands and adjacent national forests, there will be an increasing demand for wood fiber from the Flathead. If supplies increase from private and state lands and adjacent national forests, there may be a decrease in demand for wood fiber from the Flathead. A decrease in demand may reduce the amount of timber sold from the Flathead under all alternatives.

Subdividing corporate timberlands

Montana, like many states across the West, is experiencing a massive divestiture of commercial timberlands for development and subdivisions (Montana DNRC 2010). Corporate timberland has become more valuable for recreational or residential real estate than for timber production. This development results in increased fragmentation of forested landscapes and decreased timber harvest on private lands. The increased fragmentation limits the amount of harvest that may occur on adjacent national forest lands, while the decreased supply from private lands increases the demand for timber harvest from the Flathead. The limit on timber harvest from fragmentation of adjacent lands would limit the amount of timber sold from the Flathead under all alternatives.

3.21 Other Forest Products, including Huckleberries

Special forest products are mainly plant and fungi materials that are gathered from national forest lands for personal use, for commercial resale, or for sale as a craft product. They can generally be categorized under five general areas: residential comfort and use, food, herbs and medicinal, decorative, and specialty items. Huckleberries (*Vaccinium membranaceum*) have been identified as a key ecosystem component for the Forest and will receive special focus in this analysis of special forest products.

3.21.1 Legal and administrative framework

36 CFR 223.1: Trees, portions of trees, and other forest products on NFS lands may be sold for the purpose of achieving the policies set forth in the Multiple Use Sustained Yield Act as amended and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended.

36 CFR 223.239 and .240 Sale and Disposal of NFS Timber, Special Forest Products, and Forest Botanical Products: Section 223.239 provides regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products. Section 223.240 provides regulations regarding harvest of special forest products by Tribes with treaty or other reserved rights.

36 CFR 261.6: Lists activities regarding timber and other products that are prohibited.

Forest Service Manual 2600: Wildlife, fish and sensitive plant habitat management, Chapter 2670 Threatened, Endangered and Sensitive Plants and Animals. Avoid or minimize impacts to species whose viability has been identified as a concern.

3.21.2 Methodology and analysis process

The analysis included a review of rules and regulations for special forest and botanical products and effects. Differences between alternatives were evaluated based on the variation in MA allocations among alternatives as they influence availability or other aspects of special forest products.

Information sources

Research and information on plant physiology and location across the forest is limited for many of the plants and other material gathered as products. Best available information and research for huckleberries and other botanical products was used to inform the description of existing conditions and potential effects.

Analysis area

The analysis area is the national forest lands within the Forest. Analysis area for cumulative effects includes lands in other ownership adjacent to and within the administrative boundary of the Flathead Forest.

3.21.3 Affected environment (existing condition)

General information

Special forest and botanical products include, but are not limited to, mosses, fungi (including mushrooms), roots, bulbs, berries, seeds, wildflowers, forbs, sedges, grasses, nuts, ferns, boughs, bark, cones, burls, transplants, Christmas trees, firewood, posts and poles, mine props, and rails. Some of the most popular special forest and botanical products on the Forest are huckleberries, firewood, post and poles, Christmas trees, mushrooms, and boughs.

Special forest products may be collected forest-wide, unless an area has been closed for a specific reason. Existing uses are often tied to historical knowledge and patterns of use. Special forest products are available through commercial harvest and sale, with some available through free use. Historically, the Forest has granted commercial and free use of special forest and botanical products to individuals and Tribes with treaty and other reserved rights.

The supply of special forest products is dependent on ecological conditions and existing distributions of potential growing sites. Forest management or natural disturbances can influence the supply of certain products. For example, fire can increase availability of firewood and mushrooms, but may decrease available of huckleberries in the short term. Thinning of young sapling stands and conifer regeneration after fire or harvest can increase production of Christmas trees for a period of time.

Special forest and botanical products have importance to the Tribes as traditional and cultural uses. As per current handbook direction (2409.18, section 87.13), the Forest considers “treaty rights, customary and traditional uses (including subsistence and other historical uses of plant material by Tribes), the federal trust responsibility to Tribes, and competitive market demands in determining which products would be excluded from or allowed for sale to commercial harvesters. When there is a shortage of any particular special forest product for tribal use, commercial permits will be issued only to the extent that the tribal use can be accommodated.” The Forest consults and coordinates with tribal governments prior to issuing any permits, contracts, or other authorized instrument when there is a possible impact to tribal treaty and other rights and interests in the permitted or contracted area (handbook direction 2409.18, section 87.18). The Forest honors the

unique legal relationship, including the trust relationship, between the federal government and Indian tribal governments.

In addition, the Forest Service has the responsibility to honor Indian Tribes' reserved rights (handbook direction 2409.18, section 87.2). The gathering of forest products by the Confederated Salish and Kootenai Tribes is a reserved right on the Forest. The Salish Kootenai may remove special forest and botanical products without charge or permit (36 CFR 223.239(e)). The Flathead Indian Reservation, which is home to the Confederated Salish and Kootenai Tribes, shares a border with the Forest on its southwestern boundary.

Huckleberries

Huckleberries are a specific special forest product identified as a key ecosystem component for the Forest. This is because of their fruit, which is highly sought-after by both humans and wildlife. Large quantities of the berries are collected in the wild and sold both locally and nationally, either fresh or in products such as jams, wines, sauces, and creams. Huckleberries are an important food for black and grizzly bear (refer to wildlife section of this EIS), as well as many bird species. Huckleberries were, and remain so in some areas, an important food source for Native Americans, who both ate them fresh and dried them for consumption through the winter months.

Huckleberries grow as an understory shrub, commonly reaching 2 to 3 feet in height, producing berries that look similar to a blueberry, though usually smaller, stronger flavored and more tart. They grow slowly, requiring many years before fruiting is at full production, and berry production varies widely between individual plants even if on the same site.

Huckleberries grow within a wide range of coniferous forest types on the Forest, from river valley bottoms up to upper subalpine ridges, and on all aspects. However they are most abundant and have best berry production on gently sloping or northerly aspects at mid elevations (i.e., 4000 to 6000 feet), where relatively cool, moist conditions prevail. Berry production also tends to be better in more semi-open or open forest conditions, as compared to dense closed canopy forests (Minore 1984). However, on the drier south and westerly slopes, berry production may be better in more densely forested areas, because of the moisture stress and exposure to sun scalding and wind desiccation that may occur in more open conditions (Arno et al 1985).

As with all other vegetation in the Northern Rocky Mountains, huckleberries have evolved with fire as a major disturbance process. They are well adapted to persist and regenerate in the mixed and high severity fire regimes of the Forest. Fire is advantageous to huckleberry production and plant vigor in-so-far as it reduces density of overstory tree canopies and reduces competing vegetation (Miller 1978, Minor 1984). Huckleberries will generally survive low to moderately severe fires, attaining pre-fire coverage or greater within 3 to 7 years. Though the above-ground plant parts may be consumed by fire, rhizomes as deep as 6 inches underground will resprout after fire. Stand replacing (high severity) wildfires may result in moderate to high mortality or greatly reduced sprouting, with recovery to pre-fire levels taking up to 20 years (Bradley et al 1992, Coates and Haeussler 1986, Miller 1978, Stark 1989, Arno et al 1985). Huckleberry showed good vegetative response in lightly burned areas of western larch/Douglas-fir forests in western Montana. The same result was seen in moderate severity fires top-killing the majority of shrubs and consuming up to half of the litter (Steele and Stark 1977). In moist Douglas-fir habitat types of Montana, where ponderosa pine and lodgepole pine are seral components, low severity burning in the early spring stimulates huckleberry, increasing shoot density (Steiger 1980, Davis et al 1980, Bradley et al 1992). Because of these responses of huckleberries to fire, the pattern, intensity, and frequency of

fire across the landscape will heavily influence the pattern of huckleberry abundance and berry production, both in the short and long term.

Currently, the sole source of huckleberries are from wild plants, gathered by hand-picking from the bushes, with some gatherers using rakes. Commercial cultivation of huckleberries via cuttings has been unsuccessful, presumably due to lack of key fungal associations (mycorrhizae) that occur in native forests between huckleberries and surrounding plant species. Propagation by seed has been successful but not widely used commercially.

3.21.4 Environmental consequences

General effects common to all alternatives

Commercial use of special forest products is not allowed in designated wilderness; recommended wilderness; portions of designated and eligible wild and scenic rivers; special areas; research natural areas, and the Coram Experimental Forest. Special forest and botanical products may be collected for personal (non-commercial) use forestwide except in research natural areas.

Effects by alternative

Table 58 and table 59 display the acres by alternative where commercial and personal use of special forest products is and is not allowed. The acres under the existing plan (alternative A) are the acres of existing MAs considered equivalent in management direction to the MAs in the action alternatives.

Table 58. Acres of MAs where commercial use of special forest products is and is not allowed by alternative

Management Area	Alt. A	Alt. B	Alt. C	Alt. D
Not Allowed MAs (1a,1b,2a[a],2b[b],3a,3b,4a,4b[c])	1,198,128	1,312,645	1,622,869	1,150,894
Allowed MAs (3a,4b[a],5a,5b,5c,6a,6b,6c, 7)	1,194,679	1,080,162	769,938	1,241,913
Total Acres:	2,392,807	2,392,807	2,392,807	2,392,807

[a] Designated rivers: Not allowed in wild or scenic sections, allowed in recreation sections
b Eligible rivers: Not allowed in wild section, allowed in scenic and recreation sections
c Coram Experimental Forest is not allowed, Miller Demonstration Forest is allowed.

Table 59. Acres of MAs where personal use of special forest products is and is not allowed by alternative

Management Area	Alternatives A, B, C, D
Not Allowed MAs (4a)	9,870
Allowed MAs (1a,1b,2a,2b,3a,3b,4b,5a,5b,5c,6a,6b,6c,7)	2,382,937
Total Acres:	2,392,807

As indicated in table 58, acres where commercial use of special forest products may be allowed differs between alternatives, with alternative D having the most acres and alternative C the least. Alternatives A and B are intermediate between C and D, though closer in acres to alternative D. As indicated in Table 59, acres available for personal use of forest products is the same between all alternatives.

Management areas that are suitable for commercial or personal use of special forest products and that allow access by road or trail would provide greater potential opportunities for gathering of special forest products. Conversely, the potential for over-harvest of special forest products may increase with greater access. In general, the MAs expected to have the most road access are those that are established in the plan as suitable for timber production, because roads are more likely to exist for vegetation management purposes. The MAs suitable for timber production in alternatives B, C and D are MA 6b, 6c, 4b and portions of MA 7. Table 60 displays the total acres within these MAs (or equivalent MA designation in the case of alternative A, the existing forest plan).

Table 60. Acres within MAs designated suitable for timber production, reflecting the area with higher potential for opportunities to gather special forest products from roads

Alternative A	Alternative B	Alternative C	Alternative D
709,874	638,301	412,688	641,541

Restrictions on the use of wheeled motorized vehicles on roads and trails would occur under all alternatives. Alternative A retains the 1986 management direction regarding forest plan amendment 19 (grizzly bear habitat direction). This would result in a decrease in the current amount of wheeled motorized use, with approximately 500 miles of roads and 57 miles of motorized trails closed and/or decommissioned to fully meet amendment 19 standards. Motorized wheeled access for gathering of special forest products is likely to be most restricted over time under alternative A. Alternatives B and D would result in no change from current conditions for wheeled motorized use, and would have little to no effect and the area potentially accessible by motorized wheeled vehicles for the gathering of special forest products. Alternative C would decrease the amount of suitable wheeled motorized use compared to current, by an estimated 75 miles across the forest, resulting in greater motorized restrictions than alternatives B and D, but probably less than alternative A. In all alternatives, though motorized use on roads and trails may be restricted, walking and mountain biking are usually allowed. Please refer to the Recreation and Access section of this DEIS for greater discussion of changes in wheeled motorized road and trail access by alternative.

Huckleberries

Management activities, such as logging, that impact ground vegetation and soils can affect huckleberry cover and productivity. Regeneration harvests tend to have more ground disturbance than intermediate harvests (e.g., commercial thinning), because more trees are removed, and the site is prepared for tree regeneration. The rhizomes and roots of huckleberry are sensitive to disturbance. Initial decreases in huckleberry often occur after mechanical logging and slash treatment or after broadcast burning of slash (Arno et al 1985, Coates and Haeussler 1986, Oswald and Brown 1993, Martin 1979). These effects are generally temporary, though recovery to pre-treatment conditions may take several years.

Opening the stand through harvest increases the amount of sun, which has potential to improve conditions for huckleberry growth and berry production over the long term compared to pre-harvest conditions. On steeper south or west facing aspects where plants are subject to moisture stress, recovery after harvest may take longer than on moister sites, continuing until the forest grows sufficiently to provide shade to understory plants (Arno et al 1985).

Alternatives vary in the acres suitable for timber production and in the expected acres treated with timber harvest over the life of the plan. Table 61 displays the acres by alternative where timber production is suitable, and the expected acres of timber harvest. Refer to the Timber section of this DEIS for additional details on determination of the suitable lands and harvest amounts.

Table 61. Acres suitable for timber production by alternative, and expected annual average timber harvest outputs over the next two decades

Area	Alternative A Acres	Alternative B Acres	Alternative C Acres	Alternative D Acres
Total lands suited for timber production[a]	526,900	499,100	317,300	500,400
Total acres treated by timber harvest over the next two decades[b]	1,640	2,823	1,743	1,870
Portion of the total acres harvested that is regeneration harvest.	1,140	1,891	244	1,370
Portion of the total acres harvested that is commercial thin or group selection harvest.	500	932	1,499	500

[a] As defined by the Planning Rule and described in the Timber section of this EIS (in contrast to the total acres within MAs designated suitable for timber production, displayed in table 3).
[b] Source: SPECTRUM model

Though the existing plan (alternative A) has the highest amount of area suitable for timber production, the amount of expected total timber harvest acres is lowest among the alternatives, and the portion that is regeneration harvest is also among the lowest. Therefore, it has one of the lower potential for impact to huckleberries that might be caused by harvest among the alternatives. Alternative C has a lower potential for harvest impacts as well, with most of the harvest being intermediate harvest types, and with the lowest amount of acres suitable for timber production among the alternatives. Alternatives B and D fall in the middle, with alternative B having a somewhat higher potential for adverse direct impacts than alternative D due to the greater proportion of regeneration harvest types.

Conversely, because of the potential for better huckleberry growth and production with increased sunlight, harvest treatments that open up dense forest stands where huckleberry is present have the potential to improve berry production. Commercial thin treatments can be particularly beneficial, because it creates a favorable semi-open forest condition. Alternative C is anticipated to treat the most forest with non-regeneration harvest, followed by alternative B. Alternatives A and D are anticipated to have the least amount of intermediate treatments.

All these potential effects are very general in nature, with both the existence and degree of effect entirely dependent on site and treatment-specific factors. For example, harvest areas may or may not have huckleberries present or capable of growing on the site. Berry production varies widely both across sites and seasons, affected by weather, past wildfire events, and other factors out of human control. Ground disturbance from harvest varies by logging method, season of harvest, site preparation method, and other treatment factors.

Management direction for special forest products and huckleberries

There is no forest plan direction related directly to huckleberries in the 1986 plan or to the gathering of special forest products.

The proposed plan under all action alternatives provides direction to provide for sustainable levels of all forest products, including special forest products. Forest plan components provide for protection of Tribal treaty rights related to harvestable plants, including access to the forest for effective exercise of gathering rights. All the action alternatives have forest plan components that provide for sustainable harvest of huckleberries by people and encourage the use of non-destructive

berry harvesting methods. These serve to protect current and future availability of huckleberries for both wildlife and human uses.

All alternatives, including the no action, include plan components that protect soil quality and sustain soil ecological functions during vegetation management activities. These components also serve to protect huckleberry plants, roots and rhizomes from excessive damage.

Consequences to special forest products and huckleberries from forest plan components associated with other resource programs or revision topics

Effects from fire and fire management

Fire may increase or decrease the potential availability of some special forest products, such as mushrooms and firewood. Potential wildfire over the next five decades has been modeled to assess changes to vegetation conditions (refer to Fire and Fuels section and to the Vegetation section of this EIS). Future wildfire patterns and amounts have a relatively high degree of uncertainty, and modeling portrays a range of possible wildfire acres, which were the same for all alternatives. Therefore, all alternatives would have similar potential to provide for some special forest products linked to fire events, specifically firewood, mushrooms, and in some areas huckleberries.

The inter-relationship of fire with huckleberry presence and production is discussed under the affected environment section above. As mentioned, huckleberry is well adapted to persist under the natural fire regimes of the Flathead Forest, and its abundance and distribution is strongly influenced by fire. Fire suppression or exclusion will also have an influence, depending upon the status of the huckleberry at a particular site. Fire exclusion and suppression may result in maintained or increased berry production (i.e., in an early successional forest where plants are increasing in vigor) or in decreased production (i.e., in a forest that is increasing in density and canopy closure).

Fire will remain the primary disturbance factor on huckleberry abundance and production in the ecosystems of the Flathead Forest. Amount, location and intensity of future fire, both planned and unplanned ignitions, are uncertain but are expected to occur to similar degree under all the alternatives, because climate and weather are primary drivers. Therefore, the potential effect to huckleberry production is expected to be similar under all alternatives. This effect will be highly varied across the landscape, depending on fire location and severity. The species is well adapted to persist under native fire regimes and is expected to benefit in the long term from the diverse forest conditions created by fire.

Effects from vegetation management

Timber harvest and other vegetation management activities may increase or decrease the potential availability of some special forest products. Firewood may increase, either due to an increase in commercial firewood sales or as a by-product of other commercial timber sales. All alternatives propose timber harvest to some amount, and thus would all have opportunity to increase the potential availability of certain special forest products.

Timber harvest activities may have impacts on huckleberries, as described in the effects above.

3.21.5 Cumulative effects

Flathead County and surrounding counties have experienced high rates of population growth over the past couple decades (refer to Population Demographics section under section 3.26). With this increased growth rate comes increased pressure on national forest lands for a variety of societal needs and desired, including use of special forest products and huckleberry gathering. The

sustainable use of some of these resources may become increasingly vulnerable, requiring permitting and limitation of use.

The expected change in climate in future decades could influence availability of some special forest products. Insofar as it alters growing conditions of a site, climate change could influence presence and productivity of huckleberries and other plants. Increased frequency or severity of fire could also cause changes or shifts on the landscape in plant species compositions or abundance. More firewood may be available with increased size or frequency of fire, but increase in fire may eliminate other special products, at least over the short term (such as huckleberries). Significant uncertainty exists regarding possible effects of climate change on vegetation, and thus on the availability and distribution of plants that are gathered as special forest products.

Past logging practices have impacted huckleberry production on the Forest, both by decreasing or increasing berry production, depending on site, types of treatments, and time since harvest. Previously harvested areas are in various stages of recovery. More recently harvested areas may still be experiencing an initial decline in huckleberry production, but are expected to trend upwards in response to the increased light, as the forest and vegetation recovers.

3.21.6 Effects summary

Differences between alternatives related to the gathering opportunities or potential impacts to special forest products are largely linked to the degree of road or trail access and vegetation management activities. Alternatives A and C are expected to decrease wheeled motorized road and trail access forest-wide, and also have the lower acreage of expected timber harvest over the next two decades. Opportunities to gather special forest products via wheeled motorized access would be least available under alternatives A and C; however, these alternatives would have the least potential to adversely affect huckleberry production from timber harvest activities. Alternatives B and D would not change current levels of wheeled motorized access, and opportunities to gather special forest products would not change. These alternatives would have the most potential to adversely affect huckleberry production from timber harvest activities.

Under all alternatives, gathering of special forest products for personal use is allowed over the vast majority of NFS lands. Though wheeled motorized access is limited, hiking is not. Biking or horseback riding are also widely available forms of access to lands for gathering of special forest products.

All action alternatives provide forest plan direction to provide for sustainable levels of all forest products, including harvest of huckleberries by people. Huckleberry production and protection measures are the same among all the action alternatives, with plan components that stress less destructive gathering methods, and that limit soil disturbance during logging operations. The existing plan provides no specific direction related to huckleberries.

3.22 Mineral Resources

3.22.1 Introduction

The 192-million-acre NFS is an important part of the nation's resource base. As directed by the Organic Administration Act of 1897 and the Multiple Use-Sustained Yield Act of 1960, the national forests are managed by the USDA's Forest Service for continuous production of their renewable resources – timber, clean water, wildlife habitat, forage for livestock, and outdoor recreation.

Although not renewable, minerals are resources of the national forests and are important to the nation's welfare. The national forests contain much of the country's remaining stores of mineral resources. Prime examples include: the national forests of the Rocky Mountains, the Basin and Range Province, the Cascade-Sierra Nevada Ranges, and the Alaska Coast range.

Forest Service role in minerals management

In the Mining and Minerals Policy Act of 1970, Congress declared that it is the continuing policy of the federal government, in the national interest, to foster and encourage private enterprise in (among other goals) the development of domestic mineral resources and the reclamation of mined land. This federal policy applies to NFS lands.

The Forest Service recognizes the importance of NFS mineral resources to the well-being of the nation, and encourages bona-fide mineral exploration and development. But, it also recognizes its responsibility to protect the surface resources of the lands under its care. Thus, the Forest Service is faced with a double task: to make minerals from national forest lands available to the national economy, and at the same time, minimize the adverse impacts of mining activities on other resources.

Land management planning, as mandated by the National Forest Management Act of 1976, is a principal tool for assuring that mineral resources are given proper consideration. Before plans are approved, specialists evaluate resource activities including existing and potential mineral development. Planners and decision makers then formulate plans to minimize potential resource conflicts and maximize the various uses and values of NFS lands. Since mineral resources are often sub-surface, relatively rare, and are governed by certain preferential laws, the land management planning procedures provide for the availability of minerals and development of mineral operations where possible.

Minerals management of NFS lands requires interagency coordination and co-operation. Although the Forest Service is responsible for the management of surface resources of NFS lands, the Bureau of Land Management is primarily responsible for management of government-owned minerals. Since it is not possible to separate mineral operations from surface management, the agencies have developed cooperative procedures to accommodate their respective responsibilities.

There are three types of mineral and energy resources:

- **Locatable minerals**: Includes commodities such as gold, silver, copper, zinc, nickel, lead, platinum, etc. and some nonmetallic minerals such as asbestos, gypsum, and gemstones. Lands that are open to location under the Mining Law of 1872 guarantees US citizens the right to prospect and explore lands reserved from the public domain and open to mineral entry. The right of access for exploration and development of locatable mineral is guaranteed.

- **Leasable minerals**: Includes commodities such as oil, gas, coal, geothermal, potassium, sodium phosphates, oil shale, sulfur, and solid leasable minerals on acquired lands. Currently there are 341 suspended oil and gas leases covering approximately 641,500 acres on the Forest. No activity can take place on the leases until an EIS is completed. A leasing decision will not be a part of this Forest Plan Revision.

- **Salable minerals**: Includes common varieties of sand, stone, gravel, cinders, clay, pumice and pumicite. The Forest Service has the authority to dispose of these materials on public lands through a variety of methods. The disposal of these materials is discretionary.

3.22.2 Legal and administrative framework

Law and executive orders

Surface management authority

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended; 16 U.S.C. § 473 et seq.): This act provides the Secretary of Agriculture the authority to regulate the occupancy and use of NFS lands. It provides for the continuing right to conduct mining activities under the general mining laws if the rules and regulations covering NFS lands are complied with. This act recognizes the rights of miners and prospectors to access NFS lands for all proper and lawful purposes, including prospecting, locating, and developing mineral resources.

Multiple-Use Sustained-Yield Act of June 12, 1960 (P.L. 86-517, 74 Stat. 215; 16 U.S.C. 528 et seq.): This act requires that NFS lands be administered in a manner that considers the values of the various resources when making management decisions and specifically provides that nothing in the act be construed to affect the use or administration of the mineral resources on NFS lands.

Wilderness Act of September 3, 1964 (P.L. 88-577, 78 Stat. 890; 16 U.S.C. § 1121, et seq.): This act provides that, subject to valid rights existing prior to January 1, 1984, wilderness areas are withdrawn from all forms of appropriation and disposition under the mining and mineral leasing laws. Subsequent acts designating additional NFS lands as wilderness may contain specific provisions concerning mineral activities. Patents issued under the mining laws for mining claims staked after passage of this act within wilderness areas shall reserve the surface rights to the United States. The act provides for reasonable access to valid mining claims and other valid occupancies inside wilderness areas. The act also requires the survey of wilderness areas by the U.S. Geological Survey on a planned, recurring basis consistent with the concept of wilderness preservation to determine the mineral values that may be present.

National Environmental Policy Act (NEPA) of 1969, January 1, 1970 (P.L.91-190, 83 Stat. 852; 42 U.S.C. § 4331 et seq.): This act requires federal agencies to use a systematic interdisciplinary approach to ensure the integrated use of natural and social sciences in planning and decision making. It also requires an analysis of probable environmental effects of proposed federal actions. Generally, decisions on mineral and energy development are subject to this law.

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 (P.L. 93-378, 88 Stat. 476; 16 U.S.C. § 1600 et seq.): This act directs the assessment of all resources on NFS lands to determine the desired level of future production from Forest Service programs. Once approved, the policy statement and recommended program serve as a guide to future Forest Service planning and a basis for future budget proposals.

National Forest Management Act (NFMA) of October 22, 1976 (P.L. 94-588, 90 Stat. 2949; 16 U.S.C. § 1600 et seq.): The act requires the Forest Service to establish a comprehensive system of land and resource planning, including the development and maintenance of a comprehensive and detailed inventory of lands and resources. The act also specifies the use of a systematic interdisciplinary approach to achieve integrated consideration of the physical sciences into planning for the management and use of NFS lands and resources.

Mineral management authorities

U.S. Mining Laws Act of May 10, 1872 (17 Stat. 91, as amended, 30 U.S.C. § 22 et seq): This act (often referred to as the General Mining Act of 1872) sets forth the principles of discovery, right of

possession, assessment work, and patent for hard-rock minerals on lands reserved from the public domain. The law applies to lode, placer, mill-site claims, and tunnel sites. Except as otherwise provided, all valuable mineral deposits, and the lands in which they are found, are free and open to exploration, occupation, and purchase under regulations prescribed by law.

Organic Administration Act of 1897 (30 Stat. 11, as amended, 16 U.S.C. § 473 et seq): Reserved lands for national forests purposes and opened them to the operations under U.S. mining laws, provided individuals/operators comply with the rules and regulations of the Secretary of Agriculture. This act authorizes the Secretary of Agriculture to regulate occupancy and use of the national forests. The act permits access to national forests for all lawful purposes, including prospecting and locating and developing mineral resources.

Weeks Law Act of March 1, 1911 (P.L. 61-435, 72 Stat. 1571, as amended, 16 U.S.C. § 480 et seq): This act authorized the federal government to purchase lands for stream-flow protection, and maintain the acquired lands as national forests.

Mineral Resources on Weeks Law Lands Act of March 4, 1917 (P.L. 64-390, 39 Stat. 1149, 16 U.S.C. § 520): This act authorizes the Secretary of Agriculture to issue permits and leases for prospecting, developing, and utilizing hard-rock minerals on lands acquired under the authority of the act. This authority was later transferred to the Secretary of the Interior.

Mineral Leasing Act of February 25, 1920 (P.L. 66-146, 41 Stat. 437 as amended, 30 U.S.C. § 181 et seq.): This act authorizes the Secretary of the Interior to issue leases for the disposal of certain minerals (coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The act applies to NFS lands reserved from the public domain, including lands received in exchange for timber or other public domain lands, and lands with minerals reserved under special authority.

Clarke-McNary Act of June 7, 1924 (P.L. 68-270, 43 Stat. 653 as amended, 16 U.S.C. § 505 et seq.): All lands to which title is accepted under section 7 of this act become national forest lands, subject to all laws applicable to the lands acquired under the Weeks Act of March 1, 1911.

Mineral Materials Act of July 31, 1947 (P.L. 80-291, 61 Stat. 681, as amended, 30 U.S.C. § 601 et seq.): This act provides for the disposal of mineral materials on the public lands through bidding, negotiated contracts, and free use.

Mineral Leasing Act for Acquired Lands of August 7, 1947 (P.L. 80-382, 61 Stat. 913, as amended, 30 U.S.C. § 351 et seq.): This act extends the provisions of the mineral leasing laws to federally owned mineral deposits on acquired NFS lands and requires the consent of the Secretary of Agriculture prior to leasing.

Multiple Use Mining Act of July 23, 1955 (P.L. 84-167, 69 Stat. 368, as amended, 30 U.S.C § 601 et seq.): This act requires the disposal of common varieties of sand, stone, gravel, pumice, pumicite, and cinders under the provisions of the Materials Act of July 31, 1947, and gives to the Secretary of Agriculture the authority to dispose of these materials. It also provides that rights under any mining claim located under the mining laws are subject to the right of the United States to manage and dispose of surface resources.

Geothermal Steam Act of December 24, 1970 (P.L. 91-581, 84 Stat. 1566, 30 U.S.C. § 1001-1025): This act provides the Secretary of the Interior the authority to lease NFS lands for geothermal steam development, subject to the consent and conditions the Secretary of Agriculture may prescribe.

Mining and Minerals Policy Act of December 31, 1970 (P.L. 91-631, 84 Stat.1876, 30 U.S.C. § 21a): This act states that the continuing policy of the federal government is to foster and encourage private enterprise in the development of economically sound and stable domestic mining and minerals industries and the orderly and economic development of domestic mineral resources.

Federal Coal Leasing Amendments Act of August 4, 1976 (90 Stat. 1083; 30 U.S.C. § 201 et seq.): This act amended the Mineral Lands Leasing Act of February 25, 1920 (para. 3) by specifying that coal leases on NFS lands may be issued only after the consent of the Secretary of Agriculture and adherence to conditions the Secretary may prescribe. The act also provides that no lease shall be issued unless the lands involved in the lease have been included in a comprehensive forest land and resource management plan and the sale is compatible with the Plan. The act authorizes the issuance of a license to conduct exploration for coal.

Federal Land Policy and Management Act of October 21, 1976 (P.L. 94-579, 90 Stat. 2713, 43 U.S.C. § 1701 et seq., 7 U.S.C. § 1212a, 16 U.S.C. § 478a, 1338a): This act defines procedures for the withdrawal of lands from mineral entry. It reserves to the United States the rights to prospect for, mine, and remove the minerals in lands conveyed to others and requires the recordation of claims with the Bureau of Land Management.

Surface Mining Control and Reclamation Act of August 3, 1977 (P.L. 95-87, 91 Stat. 445, 30 U.S.C. § 1201-1328): This act provides for cooperation between the Secretary of the Interior and states in the regulation of surface coal mining. It also restricts or prohibits surface coal mining operations on NFS lands, subject to valid existing rights and compatibility determinations.

Energy Security Act of June 30, 1980 (P.L. 96-294, 94 Stat. 611, 42 U.S.C. § 8855): This act directs the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on NFS lands, notwithstanding the current status of the forest land and resource management plan.

National Materials and Minerals Policy, Research and Development Act of October 2, 1980 (94 Stat. 2305; 30 U.S.C. §1601-1605): This act restates congressional intent to promote policies that provide for an adequate and stable supply of materials while considering long-term needs, a healthy environment, and natural resource conservation. The act also requires the Secretary of the Interior to improve the availability and analysis of mineral data in federal land use decision making.

Omnibus Parks and Public Lands Management Act of 1996 (P.L. 104-333, 110 Stat. 4093, 16 U.S.C. § 497c): This act automatically withdraws from all forms of appropriation under the mining laws and from disposition under all laws pertaining to mineral and geothermal leasing all lands located within the boundaries of ski area permits.

Federal Onshore Oil and Gas Leasing Reform Act of 1987 (30 U.S.C. § 181 et seq.): This act expands the authority of the Secretary of Agriculture in the management of oil and gas resources on NFS lands. The Bureau of Land Managementcannot issue leases for oil and gas on NFS lands over the objection of the Forest Service. The Forest Service must approve all surface disturbing activities on NFS lands before operations commence.

Federal Cave Resources Protection Act of 1988 (102 Stat. 4546; 16 U.S.C. § 4301-4309): Provides for protection and preservation of caves on federal lands.

Energy Policy Act of 2005 (P.L. 109-58): Directs federal agencies to undertake efforts to ensure energy efficiency; and the production of secure, affordable, and reliable domestic energy.

Executive Order 13211 issued May 18, 2001: This executive order titled "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" requires federal agencies to prepare and submit a Statement of Energy Effects to the Office of Management and Budget describing the effects of certain regulatory actions on energy supply distribution, or use.

Executive Order 13212 issued May 18, 2001: This executive order titled "Actions to Expedite Energy-Related Projects" requires federal agencies to take actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

The Reorganization Plan No. 3 of 1946 (60 Stat. 1097; 5 U.S.C. Appendix): This transferred the functions of the Secretary of Agriculture with respect to permits and leases for hard-rock minerals on acquired Weeks Law land to the Secretary of the Interior. However, Secretary of Agriculture Consent to the issuance of permits or leases is required.

128 Stat. 3828 (P.L. 113–291—Dec. 19, 2014) SEC. 3063: North Fork Federal Lands Withdrawal Area. "To withdraw certain Federal land and interests in that land from location, entry, and patent under the mining laws and disposition under the mineral and geothermal leasing laws and to preserve existing uses" (see figure B-53). Nothing in this section prohibits the Secretary of the Interior from taking any action necessary to complete any requirement under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) or the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) required for permitting surface-disturbing activity to occur on any lease issued before the date of enactment of this Act.

Code of Federal Regulations

36 CFR 228 – Minerals: These regulations set forth rules and procedures governing use of the surface of NFS lands in conjunction with operations authorized by the general mining laws, oil and gas leasing, and mineral material disposal laws.

- Subpart A: Locatable Minerals
- Subpart B: Leasable Minerals (reserved)
- Subpart C: Disposal of Mineral Materials
- Subpart D: Miscellaneous Minerals Provisions
- Subpart E: Oil and Gas Resources.

36 CFR 251 – Land Uses
43 CFR 2300 – Land Withdrawals.

Other regulation, policy, and guidance

Interagency agreements

The Forest Service has entered into interagency agreements with agencies within the USDI to cooperate and coordinate in the management of federally owned minerals within NFS lands. The principal agreements include:

- A November 8, 1946, agreement with the Bureau of Land Management detailing procedures for mineral leases and permits administered under section 402 of the President's Reorganization Plan No. 3 of 1946.

- A May 18, 1957, MOU with the BLM describing work procedures for land applications, mining claims, and patents.
- A March 4, 1977, cooperative agreement with the U.S. Geological Survey concerning oil and gas operations.
- A May 20, 1980, MOU with the Bureau of Land Management describing the coordination of activities under the federal coal management program.
- A November 26, 1980, cooperative agreement with the U.S. Geological Survey for operations under solid mineral leases and permits.
- A December 3, 1981, MOU with the U.S. Geological Survey and the Bureau of Land Management for the geothermal steam leasing program.
- A December 11, 1989 MOU with the Montana Department of Environmental Quality (formerly Department of State Lands) to promote efficiency and effectiveness in administration and regulation of mineral resources.
- A July 31, 1990, MOU with the Office of Surface Mining Reclamation and Enforcement describing the management of surface coal mining operations on NFS lands.
- A November 11, 1991, interagency agreement with the Bureau of Land Management describing the procedures by which the Forest Service could authorize the Bureau of Land Management to offer NFS lands for oil and gas leasing.
- A November 19, 1991, interagency agreement with the Bureau of Land Management describing the procedures for coordinated administration of oil and gas operations on federal leases within the NFS.

3.22.3 Key indicators

- Locatable minerals – acres available for mineral entry (not withdrawn);
- Leasable minerals – acres available for leasing proposals and proposed no surface occupancy stipulation acreages; and
- Salable minerals-acres available for disposal of mineral materials.
- Timing and access restrictions could affect all mineral development.

3.22.4 Methodology and analysis process

The acres that are available for locatable mineral resource development are determined by subtracting the number of acres that are withdrawn from the total number of acres for the Flathead National Forest.

The number of acres that are withdrawn from mineral entry is a matter of record. By law, the Bureau of Land Management keeps official records in the General Land Office.

The number of acres that are available for leasing proposals is determined by subtracting the number of acres that are legally unavailable from the total number of acres on the Flathead National Forest. Currently there are 341 suspended oil and gas leases covering approximately 641,500 acres

on the Forest. No activity can take place on the leases until an EIS is completed. A leasing decision will not be a part of this Forest Plan Revision.

Lands which are legally unavailable for leasing are:

- Lands withdrawn from mineral leasing by an act of Congress or by an order of the Secretary of the interior;
- Lands recommended for wilderness allocation by the Secretary of Agriculture;
- Lands designated by statute as Wilderness Study Areas, unless oil and gas leasing is specifically allowed by the statute designating the study area; and
- Lands within areas allocated for wilderness or further planning in Executive Communication 1504.

The number of acres that are available for disposal of mineral materials is determined by subtracting from the total number of acres on the Flathead National Forest, the number of acres where the Forest Service has exercised its discretion to refrain from authorizing the disposal of mineral materials.

Information sources

The Bureau of Land Management keeps official records on active and closed mining claims on public lands. Current records are kept in the LR2000 database. These records are the source for the documentation of mining claims on the Flathead National Forest. Published and unpublished mineral resource assessments and maps produced by the Forest Service, Bureau of Land Management, United States Geological Survey and the Montana Bureau of Mines and Geology were reviewed to determine the occurrence potential for minerals, oil and gas, and geothermal resources.

Incomplete and unavailable information

There is no incomplete or unavailable information pertinent to energy and minerals.

Analysis area

The analysis area is the national forest lands within the Forest.

3.22.5 Affected environment (existing condition)

A variety of mineral deposit types and mineral resources, including gold, silver, and copper, occur within the boundaries of the Forest. The Forest Service recognizes that minerals are fundamental to the nation's well-being, and as policy, encourages the exploration and development of the mineral resources it is authorized to manage. The Secretary of Agriculture has provided regulations (36 CFR 228) to ensure surface resource protection, while encouraging the orderly development of mineral resources on NFS lands. Please refer to figure 1-51 which shows mineral potential on the Forest and figure 1-52 which displays oil and gas potential.

With respect to national forest management, mineral resources are divided into three groups: locatable minerals, leasable minerals, and mineral materials. The authority of the Forest Service to influence and regulate the exploration, development, and production phases of mining operations varies with each group. As a result, the Forest Service manages mineral resource programs that are specific to each group.

Locatable minerals

If the land is open to mineral entry and the mining claim is properly filed with the Bureau of Land Management, the claimant has legal title to the minerals. The Bureau of Land Management's mining claim data base, LR2000, lists active (current) and closed mining claims recorded on public lands. The status of mining claims can change on an annual basis and new claims can be recorded at any time throughout the year. In general, the Flathead National Forest is rated as having a low to very low potential for locatable minerals.

Currently, there are no authorized locatable mineral activities, such as exploration or development operations for the locatable minerals within the boundaries of the planning area. Based on the results of a July 27, 2015 query of the Bureau of Land Management mining claim data base, one active mining claim (MMC 195448) is located within the planning area. The Mary Dee II lode claim is located in the Hungry Horse Ranger District. Refer to figure 1-51 for a map of locatable minerals potential on the Forest.

Currently the 2.4 million acre Flathead National Forest contains 1,047,469 acres of designated Wilderness, which is all withdrawn from mineral entry. In 2015, Sec 3063 of the Buck' McKeon Defense Authorization Act, withdrew the North Fork of the Flathead from Mineral entry. This resulted in approximately 430,915 acres being withdrawn from location, entry and patent under the mining laws and disposition under all laws relating to mineral leasing and geothermal leasing. This does not affect minerals materials. Currently, approximately 62 percent of the Flathead National Forest is withdrawn from mineral entry as either wilderness or as a part of the North Fork of the Flathead withdrawal.

Leasable minerals

At this time, there is no leasable mineral exploration or mining activity on the forest. However, as of April 15, 2013, there were 341 suspended oil and gas leases covering approximately 641,500 acres on the Flathead National Forest (see figure 1-37). The Bureau of Land Management suspended the oil and gas leases in 1985 after the Conner v. Burford district court decision [Conner v. Burford, 605 F.Supp.107 (#.Mont.1985)]. The court found environmental "effects analysis" supporting lease issuance on the Gallatin and Flathead National Forests to be inadequate. The court specified that no activity may take place on the leases until an environmental impact statement (EIS) is completed. The 9th Circuit Court of Appeals upheld the district court decision to require an EIS prior to any post leasing activities in a January 13, 1988 decision, as amended July 1, 1988. To date a leasing EIS has not been completed. It will not be completed as a part of the Forest Plan revision. Until a leasing decision is completed no oil and gas exploration or development can take place on the Flathead National Forest. Most of the forest has moderate to high potential for the occurrence of oil and gas (Long, 1997, 1998) (see fig. 1-45), but low potential for development of these resources due to the lack of NEPA analysis discussed above. There is low occurrence potential for geothermal resources (Sonderegger and Bergantino, 1981), or any other leasable mineral on the Forest.

Salable minerals

Salable minerals also known as "common variety" minerals, they are subject to the Mineral Materials Act of 1947 (as amended). These minerals are disposed of by sale, issuance of free-use permits, or under contracts for in-service needs. These minerals include petrified wood, common varieties of sand, rock, stone, cinders, gravel, pumice, clay and other similar materials. Such common variety mineral materials include deposits that, although they have economic value, tend to be relatively widely available and do not have a distinct and special value. These minerals are most commonly used as building stone, landscaping, and constructions materials.

The Forest uses mineral material, such as gravel, riprap, and crushed aggregate for road maintenance, road construction, recreation sites and trailheads. Other uses include Forest contract work, culvert replacement and repair of damage caused by fire, floods and landslides. The mineral material utilized by the Forest is primarily derived from FS pits and quarries located in the planning area. The type volume and source of locations for in-service use varies year-by-year and according to need.

The Forest also disposes of minerals materials via free use permits. These can be issued to any state, federal, or territorial agency, unit or subdivision, including municipalities, county road districts, nonprofit association or individuals. The Glacier View Ranger District commonly issues free use permits to Flathead County for maintenance and improvement of the North Fork Road.

The forest also issues free use permits to the public for the collection of up to four tons of loose rock suitable for landscaping use from Forest administered lands along open roads. An individual may obtain a permit and collect rock, as long as it is not for commercial use, sale or barter. Only hand tools can be used to collect the rock, no digging is permitted and collection of only loose rock is authorized. On average about 75 permits are issued each year.

3.22.6 Environmental consequences

Expected future mining activity

Locatable mining activity has occurred on the Forest in the past, but in recent years there has been very little activity and nothing is currently authorized. It is likely that very little locatable mining activity will occur on the Forest over the next 15 years. The same can be said for leasable mineral activity. Oil and gas leasing cannot occur without a separate EIS, and this is not likely to be completed in the next 15 years. There is a low to no potential for any other type of leasable mineral development on the Forest within the next 15 years. Salable mineral mining activity is expected to continue at current levels, and the mineral materials are predominantly being used by the Forest and local county governments to improve and maintain roads throughout the Forest. None of the alternatives propose to make any site-specific changes to the existing availability of land for locatable minerals or leasable minerals on the Forest. No need for new withdrawals has been identified and no additional areas are proposed for withdrawal. No changes to existing access are proposed.

Locatable minerals

Alternative A has 1,506,474 acres formally withdrawn from mineral entry.

Alternatives B, C, and D do not propose any additional lands for withdrawal from mineral entry. There is no difference between the alternatives in regards to land available for locatable mineral development. A total of 1,506,474 acres of NFS lands are withdrawn from mineral entry for all alternatives.

Leasable minerals

Alternative A would continue to make 1,506,474 acres administratively unavailable for mineral leasing and, approximately 180,960 acres where leasing would continue to not be compatible with long-term goals.

Alternatives B, C, and D do not propose to make any lands administratively unavailable for mineral leasing. Alternatives B and D don’t make any stipulations as to surface use or occupancy. Alternative C does propose no surface occupancy stipulations on any future oil and gas leases

within the primary conservation area or zone 1. Any other stipulations would be identified at the site-specific level through the National Environmental Policy Act process.

In relation to access, alternatives A, B, C, and D is impacted the same by the inventoried roadless area management regulations. Road construction or reconstruction associated with mineral leases may not occur in inventoried roadless areas.

Leasable mineral suitability

Table 62. Acres suitable for mineral leasing across all alternatives

Area	Alt A acres	Alt B acres	Alt C acres	Alt D acres
Total NFS lands	2,413,573	2,413,573	2,413,573	2,413,573
Total lands closed to mineral leasing	1,506,474	1,506,474	1,506,474	1,506,474
Management areas not suitable for mineral leasing	180,960	522,742	747,477*	513,018
Total lands suitable for mineral leasing	716,085	374,321	149,586	384,045

*Alternative C has no surface occupancy for leasable minerals within the NCDE primary conservation area and zone 1.

Salable materials

The type, volume and source location of in-service mineral material varies year-by-year and according to need. The Forest in-service pits, type of material and quantities for fiscal years 2012 and 2013 are listed below in table 63 and table 64.

Table 63. Forest in-service mineral material use for fiscal year 2012

Pit Name	Type	Volume (cubic yards)
007 Quarry	riprap	321
007 Quarry	¾” crushed aggregate	370
007 Quarry	large rock	17
Airport Pit	crushed gravel	800
Airport Pit	¾” crushed aggregate	560
Piper Creek	crushed aggregate	410
Langford Pit	pit run material	500
Logan Pit	¾” crushed aggregate	20
Logan Pit	riprap	50
McGovern Pit	¾” crushed aggregate	10
Owl Pit	¾” crushed aggregate	40

Table 64. Forest in-service mineral material use for fiscal year 2013

Pit Name	Type	Cubic Yards
Owl Creek	crushed aggregate	120
007	crushed aggregate	4,310
Piper Creek	crushed aggregate	3,316
Peters Quarry	riprap	100
Peters Quarry	crushed aggregate	30
Spotted Bear Airport	crushed gravel	150

Pit Name	Type	Cubic Yards
Kraft	riprap	227
Star Logan	crushed aggregate	10
Star Logan	boulders	5
Porcupine	pit run	495

The only other type of mineral material disposal from the planning area is free use. Free use permits can be issued to any state, federal, or territorial agency, unit or subdivision, including municipalities, county road districts, nonprofit associations or individuals (36 CFR 228.57). The Glacier View Ranger District issued 36,000 cubic yards of crushed stone to Flathead County for maintenance and improvement of the North Fork Road in 2012. At this time, there are no planned sales or free use allocations to the state, county or other agencies, although they may occur in the future.

The availability of salable materials would vary by alternative in that any areas allocated as recommended wilderness (MA1b) would not be suitable for disposal of mineral materials (see table 136). Alternative C would be most limiting followed by alternative B, D, and A.

Salable minerals suitability

Table 65. Acres suitable for salable mineral disposal across all alternatives

Area	Alt A acres	Alt B acres	Alt C acres	Alt D acres
Total NFS lands	2,413,573	2,413,573	2,413,573	2,413,573
Total lands closed to mineral material disposal	1,075,559	1,315,347	1,634,384	1,127,606
Lands where MA prescriptions are not suitable for mineral material disposal	150,428	239,788	558,825	52,047
Total lands suitable for mineral material disposal	1,177,532	1,088,190	769,153	1,275,931

Consequences to minerals from forest plan components associated with other resource programs or revision topics

Effects from access and recreation management

Access and recreation management direction in any of the four alternatives would not result in any change in the lands available for locatable minerals, leasable minerals, or salable minerals development.

Effects from vegetation management

Vegetation management direction in any of the four alternatives would not result in any change in the lands available for locatable minerals, leasable minerals, or salable minerals development.

Effects from fire and fuels management

Fire and fuels management direction in any of the four alternatives would not result in any change in the lands available for locatable minerals, leasable minerals, or salable minerals development.

Effects from wildlife management

Wildlife management direction in any of the four alternatives would not result in any change in the lands available for locatable minerals, leasable minerals, or salable minerals development.

Habitat security requirements and other mineral mitigation measures for grizzly bear can be expected to affect locatable, leasable and salable mineral exploration and development. Where roads, and the access they provide, are necessary, limitations on road construction and operating seasons can be expected to have the effect of prolonging exploration or development work. Areas most affected would be bear management units in the NCDE primary conservation area (see standards FW-STD-E&M-01 thru 07 and guidelines (FW-GDl-E&M-01 thru 06). With alternative C, the no surface occupancy stipulation would apply to new oil and gas leases in all of the NCDE primary conservation area and zone 1. Although the potential on the Forest is very low, he no surface occupancy acreage proposed in alternative C would make it more costly, or infeasible to develop oil and gas resources within the primary conservation area and zone 1.

Locatable, leasable and salable mineral exploration and development is also likely to be affected in lynx analysis units in occupied habitat. Guideline HU G12 in the NRLMD Record of Decision (USDA Forest Service 2007 March) gives direction that winter access should be limited to designated routes or designated over-snow routes.

Effects from watershed, soil, riparian, and aquatic habitat management

Aquatic management direction in any of the four alternatives would not result in any change in the lands available for locatable minerals, leasable minerals, or salable mineral development.

With alternative A, surface occupancy associated with salable and leasable minerals would not be allowed in riparian habitat conservation areas unless there are no other options for location, and the riparian management objectives can be attained and adverse effects to inland native fish can be avoided (INFISH Standard MM-4). Alternatives B, C and D includes guidelines to minimize adverse effects to inland native fish species from mineral operations in riparian management zones (RMZs) and RMZs are increased to 300 feet around wetlands and increased to 100 feet adjacent to intermittent streams. Because of the low leasable mineral occurrence potential (other than oil and gas) on available lands, and the expected low demand for leases, there is likely to be little to no effect to leasable minerals. It would impact any oil and gas development by making it more expensive and possibly infeasible. Since there are plentiful sources for salable minerals outside of these conservation areas, there is likely to be little to no effect on salable minerals. This alternative would have no impact to locatable minerals.

Effects from lands and special uses management

Lands and special uses management direction in any of the four alternatives would not result in any change in the lands available for locatable minerals, leasable minerals, or salable mineral development.

Cumulative effects

Cumulative effects evaluate the potential impacts to mineral resources from the action alternatives when combined with past, present, and reasonably foreseeable actions. All lands within the Flathead National Forest GA boundaries form the geographic scope for cumulative effects. The temporal bound would be the life of the Forest Plan which is estimated to be a 15-year time span.

In order to integrate the contribution of past actions to the cumulative effects of the action alternatives and alternatives, existing conditions are used as a proxy for the impacts of past actions.

This is because existing conditions reflect the aggregate impact of all prior actions that have affected access and might contribute to cumulative effects. Mineral resources across the Forest are likely to be influenced by a variety of factors, and as described in the "Affected Environment" section, there are a number of actions that may occur over the life of the Plan.

Requests for approval of small lode and placer mining operations may occur, but it is not possible to predict how many may be submitted in any given year, or how many might be approved, but there is low potential for locatable mineral development on most of the Forest. Since Congress has imposed a moratorium on patenting of mining claims, there would be no changes in the acres of patented lands unless Congress was to lift the moratorium.

Given the low probable occurrence of leasable minerals other than oil and gas on open/ available lands on the Flathead National Forest, the court decision in Conner vs. Burford suspending existing oil and gas leases, and the improbability of an EIS for oil and gas leasing being prepared in the next 15 years, there is little likelihood of mineral lease applications being made.

Mineral material use can be expected to continue for in-service needs (e.g., road maintenance and watershed improvement activities) and as a salable commodity and would result in the further depletion of that non-renewable mineral resource from NFS lands.

Reclamation work is likely to occur on select abandoned mine sites as well as on mineral material sites that have reached the end of their useful life.

3.23 Livestock Grazing

Livestock grazing on NFS land is a valuable resource to livestock owners and has been a legitimate use of public lands since the inception of the NFS and has become an import part of the culture of the rural west of the United States. The objectives for Forest Service management of rangelands include managing range vegetation to provide ecosystem diversity, ecosystem and environmental quality while maintaining relationships with livestock owners; meeting the public's needs for rangeland uses; providing for livestock forage; maintaining wildlife food and habitat; and providing opportunities for economic diversity.

Rangeland management is an essential part of the Forest Service's multi-use strategy to manage their lands. This strategy ensures that rangelands provide essential ecosystem service such as wildlife habitat and related recreation opportunities, watershed functions and livestock forage. The Forest Service has primarily managed rangelands for livestock forage (USDA Range Program Assessment Flathead National Forest 2013).

Forage is a provisionary service in that, it is a tangible product from an ecosystem that humans use for nutrition, materials, or energy. Being a tangible product, forage is managed by the Forest Service to be sustainable, by ensuring that it will be available for future generations while still providing the other rangeland's ecosystem services required by their multi-use strategy. To accomplish this, the Forest Service divides rangelands into allotments and monitors each one to, maintain the overall rangeland health. Additionally, the Forest Service manages forage in transitory ranges. Transitory range is defined as forested lands that are suitable for grazing for a limited time following a timber harvest, fire, or other landscape events (Spreitzer 1985).

Grazing permits for each allotment are issued to eligible commercial livestock owners to graze livestock. To determine the livestock numbers per allotment, which is often called the stocking rate, rangeland managers use animal unit months. An animal unit month is defined as the amount of dry

forage required by one mature cow of approximately 1,000 pounds or its equivalent, to graze for one month. The forage allowance (see glossary) per day has been determined to be 26 pounds. In determining the animal unit months per allotment, permitted outfitters, guides, and other recreational visitors using livestock are not included.

Livestock grazing management is established through forest plans, the Forest Service grazing guidelines, and individual allotment management plans. These plans are developed to be comprehensive using sound science and incorporating public involvement. Plans are revised and updated to ensure that livestock grazing management decisions are based on existing and future ecological, social, cultural and economic conditions.

3.23.1 Legal and administrative framework

Law and executive orders

Federal acts and executive orders guide rangeland resource management and commercial livestock grazing on NFS lands. Other laws pertinent to rangeland management and livestock grazing on NFS lands can be found in Forest Service Manual 2200.

Federal law

The **Organic Administration Act of 1897** authorizes the President to modify or revoke any instrument creating a national forest; states that no national forest may be established except to improve and protect the forest within its boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States. Authorizes the Secretary of Agriculture to promulgate rules and regulations to regulate the use and occupancy of the national forests.

The **Bankhead-Jones Farm Tenant Act of 1937** directs the Secretary of Agriculture to develop a program of land conservation and use to correct maladjustments in land use and to assist such things as control of soil erosion, reforestation, preservation of natural resources and protection of fish and wildlife.

The **Wild Horse Protection Act of 1959** prohibits the use of a motor vehicle to hunt, for the purpose of capturing or killing, any wild horse, mare, colt, or burro running at large on the public lands. The act also prohibits the pollution of watering holes on public lands for the purposes of trapping, killing, wounding, or maiming any of these animals.

The **Granger-Thye Act of 1950** provides for issuance of grazing permits for a term of up to 10 years. It also provides for the use of grazing receipts for range improvement work.

The **Multiple-Use Sustained-Yield Act of 1960** provides that national forests are established and administered for several purposes, including livestock grazing. This act also authorizes the Secretary of Agriculture to develop the surface renewable resources of national forests for multiple use and sustained yield of the services and products to be obtained from these lands, without impairment of the productivity of the land.

The **Wilderness Act of 1964** provides that livestock grazing, and the activities and facilities needed to support grazing, are allowed to continue in wilderness areas when such grazing was established before the wilderness was designated.

The **National Historic Preservation Act of 1966** secures protection of archaeological resources and sites on public and Native American lands.

The **National Environmental Policy Act of 1970** directs all federal agencies to consider and report the potential environmental impacts of proposed federal actions. The act also established the Council on Environmental Quality.

The **Clean Water Act of 1972** sets the basic structure for regulating discharges of pollutants to waters of the United States.

The **Endangered Species Act of 1973** protects animal and plant species currently in danger of extinction (endangered) and those that may become endangered in the foreseeable future (threatened). The act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through federal action and by encouraging the establishment of state programs.

The **Forest and Rangeland Renewable Resource Planning Act of 1974** directs the Secretary of Agriculture to develop a process for the revision of NFS lands resource management plans. This includes the identification of the suitability of lands for resource management.

The **Federal Land Policy and Management Act of 1976** states that public lands will be managed in a manner that will provide food and habitat for fish, wildlife, and domestic animals.

The **Public Rangelands Improvement Act of 1978** recognizes the need to correct unsatisfactory conditions on public rangelands by increasing funding for maintenance and management of these lands.

The **Rescission Act of 1995** directs the Forest Service to complete site-specific National Environmental Policy Act analyses and decisions for grazing allotments on a regularly scheduled basis based on the permits requirements.

Executive orders

The **Secretary's Administrative Order of 1963** provides administration of NFS lands under Title III of the Bankhead-Jones Farm Tenant Act; establishment of national grasslands.

Regulation, policies, and guidance

The following regulations and policies have been developed to support implementation of the acts and executive orders previously presented:

Departmental Regulation, Number 9500-5, dated December 15, 1983; subject: Policy on Range.

National Grasslands Management - A Primer (1997): A document identifying and interpreting the laws and regulations applicable to the administration of the national grasslands.

36 CFR Chapter II, Forest Service, Department of Agriculture:

- 219 Planning
- 222 Range Management
- 241 Fish and Wildlife.

Forest Service manuals and handbooks:

- Forest Service Manual 2200 – this manual summarizes laws and regulations governing rangeland management and forest planning.

- Forest Service Handbook 2209.13 – Grazing Permit Administration Handbook
- Forest Service Manual 2600 – this manual summarizes laws and regulations governing fish and wildlife
- Forest Service Handbook 2609.13 – Wildlife and Fisheries Program Management Handbook

Other agreements and plans

The following agreements and plans also support the Forest Service's rangeland management program:

Memoranda of understanding for forage reserves. Forage reserves are allotments under a term grazing permit but may be used by other permittees that have been temporarily displaced due to wild or prescribed fire, drought, or other situations that have made forage unavailable.

Non-use for resource protection agreements. These agreements may be established to provide long-term non-use to allow rangelands to recover, provide forage on a temporary basis to allow resource recovery on other grazing units, provide temporary resolution of conflicts created by predation on livestock, or provide supplemental forage in times of drought to assist area livestock operators and lessen the resource impacts of grazing.

Allotment management plans: Developed through site-specific environmental analysis, an allotment management plan uses forest plan direction and current issues to determine desired conditions and a broad strategy on how to meet desired conditions. These plans describe site-specific grazing strategies, stocking, structural and non-structural range improvement needs, and coordination with other resources.

3.23.2 Key indicators

Indicators for livestock grazing within the Flathead National Forest are listed below and table 66 shows how these indicators are used in the rangeland analysis:

- Permitted use; measured as the acres of NFS land in active grazing allotments.
- Forage, via suitability and utilization for cattle; measured as animal unit months of cattle grazing.
- Forage via suitability and utilization for sheep; measured as animal unit months of sheep grazing.

Table 66: Resource indicators and measures for assessing effects from livestock grazing

Resource Element	Resource Indicator	Measure
Use	Permitted Use	Acres and percentage of allotments
Forage	Suitability and utilization	Animal unit months and available forage

3.23.3 Methodology and analysis process

The alternatives include management standards and guidelines that describe actions that may, or may not, impact the management of grazing livestock within the forest. For the purpose of this analysis, each alternative is evaluated using one or more of the key indicators to determine the overall impacts to livestock grazing within NFS land. Then, the impacts from each alternative are

compared to the current conditions, also known as the existing baseline or no action alternative, and then compared and contrasted among alternatives.

The analysis area for rangelands and allotments is within the NFS Lands of the Flathead National Forest, specifically within the area designated as the grizzly bear primary conservation area.

The National Forest Management Act of 1976 requires the identification of the suitability of lands for resource management including grazing. An analysis to determine lands capable of producing forage and suitable for grazing livestock was completed as part of the forest plan revision. Although an area may be deemed capable and suitable for use by livestock in the revised forest plan, a project-level analysis evaluating the site-specific impacts of the grazing activity, is required to authorize and dictate the management of livestock grazing in a specific allotment.

When possible, a GIS analysis of acres from a respective MA is used to quantify the impact. For example, if there are more acres available in a MA for livestock grazing under alternative B than the existing baseline, or no action alternative, than it is assumed livestock grazing would benefit more in alternative B than under the no action alternative.

For analysis purposes, when the degree of impact cannot be quantified, a qualitative assessment is used based on professional judgment and, when possible, in conjunction with available acreage data.

Assumptions

With all quantitative and qualitative analysis, the following assumptions are used to determine the degree of impacts on livestock grazing. These assumptions are based on previous assessments, professional judgment, and Forest Service Range Management Directives.

- Livestock that use rangelands can remove plant material, trample soils, and alter water flow patterns. However, with proper management these impacts are insignificant when compared with the natural resilience of ecosystems (Holling 1973). Therefore, for the purpose of this analysis, livestock grazing is not considered a surface-disturbing activity.
- Livestock grazing would be managed to meet specific standards and guidelines for rangeland health, including riparian standards and guidelines. In addition, range improvements would be used to meet standards and guidelines for rangeland health and achieve rangeland management goals.
- Within the Flathead National Forest, the grazing system in each allotment would remain the same. Additionally, the animal unit months for each allotment is not expected to increase, and remain at, relatively, current levels.
- Impacts on livestock grazing are generally the result of activities that affect forage levels or the limiting of access to designated allotments such that livestock could no longer use rangelands.
- Mitigations for impacts to, or from, livestock for any resource would be addressed in a site-specific analysis.
- Grazing use is managed similarly in all alternatives.
- Grazing allotments would remain open as long as there continues to be demand. If there is a permittee willing to vacate their allotment, it could be closed and the permit could be terminated. The decision to close an allotment and terminate a permit may be based on the

demand for permitted use and utilization of forage, or if the land is dedicated to another purpose.

Limitations

The livestock grazing analysis is limited to the active allotments within the Flathead National Forest. Livestock grazing outside existing allotments, including rangelands available to pack stock and transitory range, is included in the analysis; however, this is discussed as a qualitative assessment.

Information sources

Information sources include literature, records, and documentation review and information from Forest Service range program assessments and information from Forest Service range program managers.

Incomplete and unavailable information

Information sources used contained sufficient information to complete this analysis. Project-level analysis may require site-specific data to conduct an impact analysis.

Analysis area

The analysis area includes rangeland within active allotments on National Forest Service lands on the Flathead National Forest (for an overview of grazing allotments with the Flathead National Forest see figure 1-53). For the purposes of the cumulative effects analysis, properties adjacent to the Flathead National Forest are considered in respect to the associated permit-holding ranch operations and potential impacts to open space.

3.23.4 Affected environment (existing condition)

In 1986 there were 20 active allotments; however, over the past several years more than half have been vacated and closed. The decrease in allotments can be correlated to the decline in ranching in the Flathead Valley. With the decline in grazing, active allotments are administratively closed when they are no longer being used by the permittee. Permitted livestock numbers and seasons of use are often based on past actual and permitted use levels, but also on the site conditions.

Commercial livestock are generally authorized through issuance of a term (i.e., 10-year) grazing permit. These permits include numerous requirements and conditions and describe the responsibilities of the permit holder. These terms and conditions are also incorporated into an allotment management plan. The allotment management plan establishes site-specific goals and objectives and provides management strategies to achieve them. These strategies may include levels of grazing use, seasons of use, rotations, and a schedule for implementing range-improvement projects such as fences and water developments. This plan also includes requirements for monitoring and inspections, payment of grazing fees, ownership of livestock and base property, livestock management, range improvement maintenance and construction, and other terms as appropriate. Once approved, the allotment management plan becomes a part of the permit.

As of 2014, the Flathead National Forest had seven active range allotments that include two on the Tally Lake Ranger District and five on the Swan Lake Ranger District (table 56). All seven of the active grazing allotments are permitted for cattle grazing. There are no sheep allotments on the Flathead National Forest nor are any sheep grazing permits anticipated to be issued in the future (USDA, Range Program Assessment, 2013). Each grazing allotment lies within one of the NCDE grizzly bear management zones (table 67). The seven active allotments consist of 72,540 acres and

supports 1,407 animal unit months (USDA Flathead National Forest, Grazing Permit History 1999–2014).

Table 67. Flathead National Forest range allotments and their respective locations within the NCDE grizzly bear management zones

Allotment name and numerical identifier	Ranger district	Acres	Capable acres	Authorized animal unit months	Seasons of non-use 2006-2014	NCDE Grizzly Bear Management zone
Barber Creek	Swan Lake	7,864	5,635	206	4	Primary conservation area
Browns Meadow	Swan Lake	8,440	1,163	169	7 [a]	Zone 1
Holland	Swan Lake	20,020	5,365	265	1	Primary conservation area
Island Meadows	Tally Lake	8,461	3,125	329	1	Zone 1
Kerr Mountain	Swan Lake	11,610	212	83	0	Zone 1
Lemonade Springs	Tally Lake	10,569	6,507	329	2	Zone 1
Piper Creek	Swan Lake	5,576	5,516	26	0	Primary conservation area
Swaney	Tally Lake	[18,254]	-	Vacant	3	Zone 1
Wild Bill	Swan Lake	[9,060]	-	Vacant	3	Zone 1
Total	–	72,540 [c]	27,523	1,078 [b]	–	–

a. Grazing permit in non-use status for four consecutive years starting in 2011
b. The permittee for Island Meadows and Lemonade Springs moves the cattle between these 2 allotments so acres not counted twice in total
c. Vacant allotment acres not counted in total. No grazing permit issued, awaiting NEPA decision to be closed

Range management and the designated range allotments are administered by the District's resource assistants, with the Forest Range Program Manager providing program management and oversight. The resource assistants and the Forest Range Program Manager work with grazing permit holders to ensure that the range management goals and objectives of the allotment management plan are being met.

The current Forest Plan (USDA 1986) contains specific desired conditions, objectives, standards, and guidelines that were developed for livestock grazing. The current plan also identifies approximately 485,000 non-wilderness acres that were considered potentially suitable for livestock grazing and maximum transitory range could support a maximum of 12,000 animal unit months (Range Program Assessment Flathead National Forest 2013). Timber harvest areas create transitory range within an allotment that provides forage for livestock. As the forest grows back, the available range decreases. If adjustments are made to account for transitory range that is manageable and accessible, the Flathead National Forest could support roughly 4,120 animal unit months. The Flathead National Forest currently permits 1,407 animal unit months (table 67).

The acres of capable rangeland identified in table 67 were determined through GIS analysis. Capable acres are those areas within an allotment with the capability to produce forage and do not equal total allotment acres for several reasons. An allotment may only have a few acres of suitable grasslands within its borders and the rest may be heavy forest or rock outcrops. Some allotments may contain small amounts of capable acres that were not identified in the GIS analysis and grazing may occur in areas based on site-specific conditions.

In response to localized conditions, such as rehabilitation, drought, or predation, some allotments have sporadically been placed in non-use status, which results in actual grazing use being considerably lower than permitted use. In addition, certain circumstances may delay access to allotments (e.g., prolonged winter) and as a result some grazing seasons were temporarily shortened; however, permitted animal unit months are not affected by these conditions or circumstances.

Livestock grazing tend to have the greatest impacts on the following areas (Kauffman, Boone, and Krueger 1984):

- low-gradient riparian and wetlands areas,
- fine-textured soils with a minimal amount of rock, cobble, or boulders,
- open canopy or low shrub vegetation types,
- areas with naturally available water (although there may be some avoidance of standing water areas),
- areas of concentration due to natural or manmade obstacles (e.g., narrow drainages), and
- alpine soils (the Forest does not have any allotments in areas with alpine soils).

The magnitude of impacts depends on the timing of use, the kind and class of livestock, the intensity, duration and frequency of grazing, and the associated management practices, including the level of active permittee management and involvement.

Site-specific National Environmental Policy Act analysis for each allotment or set of allotments is completed during the allotment management planning process. The Flathead National Forest has revised allotment management plans as mandated by the 1995 Rescissions Act. Project-level allotment National Environmental Policy Act decisions were determined in consideration of the goals and objectives as well as the standards and guidelines of the approved forest plan.

In general, the grazing management program helps to ensure a reliable and consistent level of native rangeland forage for permitted commercial livestock production. This resource helps local ranches maintain an economical operation that, in turn, maintain open space adjacent to the Forest, which is integral to meeting desired resource conditions and maintaining the economic and social sustainability of local communities.

Resource indicator for permitted use

There are 72,540 acres of the Flathead National Forest within active grazing allotments (approximately 3 percent of the total acres managed by the Flathead National Forest). Of the allotment acres, only 27,523 are capable acres (approximately 1 percent of the total acres managed by the Flathead National Forest). Capability is used to determine the suitability for grazing based on lands capable of producing forage and management decisions. Of the seven active allotments within

the Flathead National Forest, three active allotments are located within the primary conservation area, while the other four are located in zone 1 (table 67). As previously stated, there are no sheep grazing allotments within the Flathead National Forest.

Resource indicator for suitability and utilization

Currently, there are 1,407 animal unit months designated on all active grazing allotments Flathead National Forest (table 67). The majority of animal unit months (910) are located within zone 1.

3.23.5 Environmental consequences

The environmental consequences section describes the effects of implementing the action alternatives on livestock grazing. The action alternatives are described in chapter 2. Effects are analyzed in relation to the no-action alternative (i.e., alternative A).

Acres available for livestock grazing and allotted animal unit months are the same for each alternative (table 56 describes these indicators for livestock grazing). Figure 1-55 provides a map of the grazing allotments. None of the action alternatives change the existing allotments nor do they provide any specific direction regarding current allotments. The most significant environmental consequence on livestock grazing from an alternative is the effect it would have on the future availability of suitable livestock grazing acres and animal unit months. Within the grizzly bear primary conservation area, the action alternatives are the same. The action alternatives differ in grizzly bear management zone 1.

The standards and guidelines are designed to protect upland and riparian resources, manage noxious weeds, and manage grazing allotments in accordance with the NCDE GBCS in all alternatives. Furthermore, there are resource mitigations and best management practices that are part of allotment plans that are designed to protect forest resources from potential disturbances of livestock grazing. These are site specific for each allotment and not part of this analysis. In conjunction with this analysis, a discussion of the social and economic impacts related to livestock grazing can be found in the social and economic sections.

Alternative A – no action

The existing forest plan, with permit and/or contract-specific terms and conditions, is the current management being used by the Flathead National Forest to address livestock grazing. This direction represents the no-action alternative and is the baseline to which the action alternatives and action alternatives are compared. Thus, it is important to understand what actions would continue under the no-action alternative.

Management direction for alternative 1 – no action

Under the 1987 Forest Plan, the management of domestic livestock grazing allotments is consistent with MA direction and MA objectives. The plan considers the dependency of the ranching community on forage management and controls grazing to support tree regeneration and to maintain water quality and fisheries habitat when grazing occurs in riparian areas. Management direction of noxious weeds is also provided (USDA 1987).

Indirect effects of the no-action alternative

Under the no-action alternative, grazing management, as outlined in the affected environment section, would continue. Additionally, allotment plans and associated protections for forest resources would also continue. Forage management would continue to provide the necessary animal unit months designated on grazing permits. The quantity and size of grazing allotments could

change from the current condition. Additional grazing allotments could be added if they were to meet the goals and guidelines of the existing MAs.

Impacts, known and unknown, to livestock grazing under the no-action alternative were considered in reference to the disturbance associated with continuing management and the proposed implementation of the GBCS. These impacts are summarized below:

Vegetation management
Under the no-action alternative, transitory range would increase in areas that experienced a timber harvest or other vegetation management action, thereby increasing the forage capacity of that allotment; however, these increases would be temporary and as the forest overstory returns, the capable range would decrease in these areas. If additional grazing allotments are added it would increase the total grazed acreage.

Riparian and wetland management
Under the no-action alternative, livestock grazing within riparian areas would be controlled to maintain water quality and fisheries habitat. This is consistent with the GBCS in that it maintains the desired species composition and ecological processes. Any additional measures to protect and mitigate impacts to riparian and wetland resources for individual grazing allotments would be addressed during site-specific evaluations prior to the issuance of the grazing permits.

Noxious and invasive species
Under the no-action alternative, management direction for noxious weeds and invasive species, would continue as part of the issuance of grazing permit process and other vegetation management programs. Specific strategies would be evaluated for site-specific projects.

Management areas
Under the no-action alternative, MA direction, as related to livestock grazing, must meet the goals established for each MA. Therefore, it is not anticipated that MA direction would impact livestock grazing because any grazing that would occur within a MA, would be consistent with the MA direction.

Grizzly bear habitat
Under the no-action alternative, new grazing permits would be allowed if they met the MA objectives and if the ranching community needs to increase the number of allotments and animal unit months within grizzly bear habitat. Although there is no history of conflicts between grizzly bears and cattle on the Forest, increased cattle numbers could slightly increase the risk of conflicts in the future (see grizzly bear section of chapter 3 for more details).

Other resources
Impacts from the no-action alternative from other resources are similar to the other alternatives. Refer to alternatives B, C, and D effects analysis sections.

Action alternatives B, C, and D

For each resource area, or activity described below, the environmental consequences to livestock grazing are compared by alternative, based on key indicators of permitted use and forage, via suitability and utilization.

Effects of forestwide direction

Effects from vegetation management

Timber harvest and other vegetation management activities can provide transitory range that would be available for livestock and wildlife grazing. Transitional range forage capacity decreases over time as the forest overstory grows back and shades the grass understory. As the overstory returns, the transitional range reduces to a level that does not provide enough grazing to be utilized. As timber is harvested, areas may open up to livestock that were not previously available, increasing capable acres. These newly accessible areas would be used as transitory range as long as the acreage occurs within an existing allotment.

Timber harvest could also open up range that is inaccessible to livestock because of natural barriers. This could cause livestock control and management problems if the previously unharvested timber stands were used as natural barriers between allotments or other critical area. If this were to occur, additional range improvements would need to be installed to control livestock access.

To evaluate the impact of vegetation management activities on livestock grazing, the acres of timber suitable for harvest is used to determine the acres that could be created into a transitory range. The location of a timber harvest (or other vegetation management activity) would need to be within an existing allotment. In most cases, grazing allotments on the Forest overlap with the wildland urban interface, where timber harvest is likely to continue to occur with all alternatives.

Under the no-action alternative (alternative A), more acres of timber would be suitable for timber harvest than under the action alternatives. Under alternative C, less acres of timber would be suitable for harvest than other alternatives. This means suitability and utilization for livestock grazing under the no-action alternative (alternative A) could result in the creation of more transitory range than the action alternatives. Alternative C has the lowest acres suitable for timber harvest and would have the lowest potential for the creation of transitory range limiting potential suitability and utilization. Under alternatives B and D, the acres available for timber harvest are about the same, and therefore the potential for the creation of transitory range is the same.

Effects from roads and trails management

The primary impact to livestock grazing from roads and trails management is focused on the level of motorized access to and on an allotment. Generally, the greater ease and availability of motorized access into and throughout the allotment, the more efficient and cost effective the management of livestock and maintenance of structural improvements can be performed. Livestock are trailed or trucked to and from grazing allotments along roads, and permittees access cow camps using travelways.

Motorized recreational use on allotments can increase the difficulty of maintaining positive control of livestock (i.e., gates may be left open and livestock are inadvertently or purposely moved), which complicates allotment management and increases management costs. Structural range improvements generally receive less disturbance and vandalism with recreational vehicles restricted to designated roads and trails; however, permit holders would need more time to obtain prior authorization to travel off roads or on trails in their allotment. Motorized winter recreation has no effect on livestock because permitted grazing does not takes place during the winter.

Evaluation of the impacts of roads and trail management on livestock is based on a qualitative assessment that compares alternatives to the no-action alternative. Based on the qualitative

assessment of the location of livestock allotments on the Forest, impacts are similar between all alternatives.

Effects from fire management

Fires and fuel management can have very differing short-term and long-term effects on livestock grazing. Effects depend upon burning conditions and burn type, because the results and timing of a wildfire are much less predictable than from a controlled burn/prescribed fire.

Prescribed burning often results in an increase in forage production and availability, and a shrub community more compatible with a variety of wildlife species. A reduction in shrub density can accelerate the recycling of nutrients, and make water more accessible across the landscape such as in springs, seeps, and intermittent streams. This accessibility can have the effect of simplifying livestock management, improving livestock or wildlife distribution, and increasing available animal unit months. An effect often results from under-burns in conifers or other types of burns that can increase forage production and accessibility. Thus, alternatives that use more prescribed fire would be expected to result in increases in the effects described above. Areas that are typically grazed may have use deferred for up to two growing seasons following a prescribed burn to allow for vegetative recovery. This “resting” requires that the permittee be flexible in management and involved in considerable advance planning and coordination. If a prescribed fire does not take place on schedule, arrangements need to be made again in successive attempts, which can accrue additional costs to the ranchers and/or Forest Service.

A wildfire can have similar effects as prescribed fire, but is likely to have unplanned adverse effects as well. Wildfire may result in the entirety of an allotment being burned and livestock may have to be completely removed from an allotment or a permittee may be forced to move their livestock to other lands in their operation (e.g., private, state). Wildfire may remove trees and open forest understories to a flush of grass and forb production for many years. Similar to prescribed fire, this can have the effect of recycling nutrients and improving the quality and quantity of forage for livestock and wildlife. However, since timing, location, and burn conditions are not controllable, wildfires are less likely to provide the same amount of positive effects as prescribed burns.

To evaluate the impact of fire management activities on livestock grazing, the projected acres of prescribed fire are used to determine areas most likely to create more suitable forage. The location of prescribed fire treatments are not known, but would need to be within an existing allotment for the fuel treatment to affect the amount of acres that could be considered suitable for livestock grazing.

Effects from Wildlife Management

There is a potential for grizzly bear-livestock conflicts to occur within grizzly bear habitat where livestock operations occur on forest lands. Many reported conflicts are associated with livestock operations, both with cattle and sheep (Wilson et al. 2005). However, conflicts between grizzly bears and cattle are rare on public land because of mitigations (e.g., the removal of boneyards, and removal dead animals quickly from grazing allotments) that are in place to reduce these conflicts. Historically, there were many conflicts between grizzly bears and domestic sheep. However, there are no sheep grazing allotments on the Flathead National Forest for this to be a concern. There is no history of grizzly bear-human conflicts or management actions in the areas related to cattle grazing on the Forest. Annual monitoring of livestock allotments is performed to check on conflicts and compliance with Food Storage Orders, which can help reduce livestock losses. Additionally, the Forest Service does coordinate and cooperate with state and other federal wildlife agencies on conflict management.

Under alternatives B, C, and D, the Flathead National Forest would continue to allow cattle grazing in the seven active allotments, but there would be no increase in cattle allotments within the grizzly bear primary conservation area. There are three active cattle grazing allotments on about 33,460 acres in the primary conservation area. Standards and regulations reduce the potential for grizzly bear-livestock conflicts (e.g., removal of carcasses within 24 hours and no boneyards on NFS lands). Although there is no history of conflicts between grizzly bears and cattle on the Forest, limits to increased cattle numbers could slightly reduce the risk of conflicts in the future (see grizzly bear section of chapter 3 for more details). With alternative C there would be the same limit on future cattle allotments as with alternatives B and D. In addition, alternative C has no increase in cattle allotments within zone 1. There are four active cattle grazing allotments on about 39,080 acres in zone 1. Rangeland management would continue to issue permits and manage allotments in accordance with the most current forest plan and allotment plans, so impacts on current grazing allotments would not occur.

Grazing livestock also share habitat resources with other wildlife species besides grizzly bears. For example, grazing cattle will use the same resources as big game species. Big game grazing and browsing is compatible with livestock grazing and browsing. There is a large dietary overlap (40 to 80 percent) between elk and cattle and a similar though smaller dietary overlap with deer (Hansen and Reid 1975, Wallmo et al. 1973). Elk grazing patterns have been shown to be strongly influenced by livestock grazing, as they seek areas of forage regrowth following grazing by livestock (Crane et al. 2001). In certain cases, limitations may be placed on forage use by permitted livestock to assure adequate forage for the wild ungulate populations, particularly on crucial winter range.

The evaluation of the effects big game habitat management has on livestock grazing is based on a qualitative assessment that compares action alternatives to the no-action alternative. Based on the qualitative assessment, effects are similar among all alternatives, including the no-action alternative. For all alternatives, including the no-action alternative, big game habitat management actions would not limit livestock forage. These impacts would not affect permitted use, and suitability and utilization within the grazing allotments.

Effects from recreation management

Recreation management can alter livestock grazing in several ways. Achieving reasonably uniform livestock distribution across an allotment is one objective of livestock management, because it allows the optimal use of available forage resources. Areas with campers, pet dogs, all-terrain vehicles, and other concentrated human activity are generally avoided by livestock. Concentrated or frequent recreation use along roads and near popular areas can cause livestock to avoid grazing or passing through an area, and work directly against a permittee's attempts to distribute livestock evenly. People using camping or picnic sites on the Forest sometimes become concerned with livestock in and around their recreation sites. Cattle are occasionally shot by mistake or otherwise during hunting seasons, or struck and injured or killed by vehicles, resulting in a direct economic loss. Fences are a common solution, but require installation and maintenance and can be costly. Fencing of roadways may result in a safer travelway for motorists and livestock, but also result in a loss of forage available to permitted livestock. Right-of-way fence can either disrupt planned grazing management or it can increase the management flexibility by creating additional pastures. Higher levels of summer recreation could create increased levels of potential conflicts with livestock grazing. Alternatives that allow more areas of motorized access in grazing allotment areas may adversely impact livestock grazing the most. Winter recreation and motorized over-snow vehicle use would not impact livestock grazing because the permitted grazing season would not occur during the winter months.

The evaluation of the impact of recreation management activities on livestock grazing is based on a qualitative assessment that compares action alternatives to the no-action alternative. Based on the qualitative assessment, effects are similar among all alternatives, including the no-action alternative. For all alternatives, allotment areas do not overlap with focused recreation areas (management area 7). Additional road closures may occur within the three allotments in the Swan Valley portion of the PCA with all alternatives, which may reduce permittee access, but the exact locations are not predictable.

Effects from noxious and invasive species

Infestations of noxious weeds can significantly impact livestock grazing if they are extensive enough to reduce the amount of available forage. Once established, noxious weeds and other invasive plant species have the ability to out-compete native vegetation for nutrients and water. In addition to being undesirable forage, noxious and invasive species are usually less dense resulting in more bare soil and a higher erosion potential, resulting in less water storage and more difficulty and expense in re-establishment of a native plant communities. Any ground-disturbing activity has the potential to expose a site to noxious and invasive plants, particularly when motor vehicles are involved. Likewise, established motorized access can make noxious and invasive plant treatment much easier and cost effective. Even though grazing can be used as a noxious weed and invasive species control mechanism, risk of spreading undesired species to other areas within the forest remains without the use of mitigations, such as cleaning livestock before and after they have been in an area known to be infested with undesired species.

The impact of noxious and invasive species management on livestock is evaluated based on a qualitative assessment that compares action alternatives to the no-action alternative. Impacts are similar between all alternatives, including the no-action alternative. The permitted use and suitability and utilization of grazing allotments would not change among alternatives. For all alternatives, noxious and invasive species management actions would not limit livestock forage. However access to areas may be temporarily closed for weed management activities. Also mitigations, such as livestock washing, may be used as part of the grazing permit and allotment plan. These temporary closures may limit access to permittee allotments.

Effects from renewable and non-renewable energy and mineral resources management

Increased energy and mineral development can lead to increased road systems, travel, and potential for the introduction of noxious weeds resulting in reduced localized forage for livestock grazing.

To evaluate the impact of energy and minerals management activities on livestock grazing, surface occupancy is used to determine the area most likely to experience potential conflicts with livestock use. Surface occupancy is defined in the mineral resources section and is used because it determines the location where impacts would be most likely to occur. Areas with no surface occupancy would not experience impacts. For impacts from energy and mineral resource activities to occur, a surface occupancy would have to occur within an existing allotment.

Under alternative C, no surface occupancy would occur in the primary conservation area or zone 1. Since all of the grazing allotments are located in the primary conservation area and zone 1, no surface occupancy would occur on the existing grazing allotments and no impacts from renewable and non-renewable energy and mineral resource management would occur.

Under the no-action alternative and alternatives B and D, surface occupancy could occur in portions of the primary conservation area and zone 1. Therefore, if the surface occupancy would occur inside

an existing grazing allotment, then the impacts discussed may potentially occur and livestock may experience less available forage and suitability and utilization could be affected.

Overall, alternative C would have no adverse effect on livestock grazing as renewable and non-renewable energy and mineral resource impacts would not occur. The no-action alternative (alternative A) and alternatives B and D could potentially impact livestock grazing by limiting suitability and utilization, but the likelihood is low because the Flathead's mineral and energy potential is low (see energy and mineral resources section of volume 2, chapter 3 for more details).

Effects from riparian and wetland management

Management and protection of riparian and wetland resources are emphasized under all alternatives. The objectives and standards for protecting riparian and wetland resources have some of the greatest influence relative to the forest grazing program achieving desired conditions. Changes have been made in grazing management and practices to protect riparian and wetland resources, which are reflected in current resource conditions. Effects to riparian and wetland management would be similar across all alternatives.

The impact of riparian and wetland management on livestock is evaluated based on a qualitative assessment that compares alternatives to the no-action alternative. Impacts are similar among all alternatives, including the no-action alternative. The permitted use and suitability and utilization of grazing allotments would not change between alternatives because management direction for all alternatives would limited access to riparian or wetland areas when conditions in the permit are not met. For all alternatives, including the no-action alternative, riparian and wetland management could limit permitted use of the allotment or livestock forage. Also mitigations, such as the construction of fences to limit access, may be used as part of the grazing permit and allotment plan. These may limit a permittee's accessibility to an allotment.

Effects from soil and watershed management

These effects would be similar as those discussed in the Riparian and Wetland Management section.

Effects from cultural and historical resources management

Livestock can contribute to the deterioration of cultural and historical resources through physical contact (e.g., hoof action, rubbing on structures) or by contributing organic matter to a site. They can remove or alter vegetation that serves to protect sites from erosion and make these resource more visible for unauthorized collection. In cases where the level of impact is determined to be unacceptable, the impacts can be mitigated with fencing or with changes in management (intensity or timing). If livestock are excluded from a site or forage use levels are reduced, total animal unit months on an allotment may be reduced, which limits a site's suitability and utilization. Impacts would be similar across all alternatives.

Effects of MA direction

Management area direction includes specific designations including administrative sites, experimental and demonstration forests, general forest, and road less areas. These areas could be grazed to maintain the vegetative desired conditions. However, livestock grazing would only occur in these areas if the permit holder has the ability to access the area and if it occurs in a permitted allotment. The MA direction would have little to no impact on livestock grazing because of the establish goals and regulations for the MA and the existing allotment plans within those MAs.

Effects from recommended wilderness

If recommended wilderness occurs within grazing allotments it could affect future management. Livestock grazing "and activities and the necessary facilities to support a livestock grazing program, will be permitted to continue in National Forest wilderness areas, when such grazing was established prior to classification of an area as wilderness" in accordance with Congressional Grazing Guidelines (Washington Office Amendment 2300-90-2, Forest Service Manual 2323.2 pp. 19-26). There is to be "no curtailment of grazing permits or privileges in an area simply because it is designated wilderness…Wilderness designation should not prevent the maintenance of existing fence or other livestock improvements, not the construction and maintenance of new fences or improvements which are consistent with allotment management plans and/or which are necessary for the protection of the range."

There no grazing allotments within recommended wilderness areas (see figure 1-01 and the recommended wilderness section of volume 2, chapter 3, for more details). Impacts to livestock grazing would not occur under any alternative.

Effects of geographic area direction

Livestock allotments occur in the Salish Mountains and Swan Valley GAs. Under alternatives B, C, and D, these GAs have transitory forage, so grazing would be available within active grazing allotments as long as grazing is compatible with other resources. Management direction would have no effect on existing livestock grazing because it does not limit permitted use within existing allotments, nor does it impact suitability and utilization of forage. Therefore, under this direction no impacts to livestock grazing would be expected to occur.

The Forest Service would continue to pursue closure for grazing allotments that fall into a non-use status. Non-use status means that a grazing allotment that is not used for three, non-consecutive, years out of a 10-year period. None of the alternatives increases the probability of an allotment falling into non-use status because if the demand for livestock grazing continues, the Forest Service will continue to maintain grazing allotments per its regulatory responsibilities.

In the Swan Valley GA, there is a guideline that states, "For efficient operation of the grazing program, open and active cattle grazing allotments should be closed if the opportunity arises with a willing permittee". Grazing allotments that are inefficient to operate may decrease in this GA in the future as a result.

Climate change

Climate change affects vegetation, which in turn could affect livestock grazing. Although outside the control of the Flathead National Forest, potential effects include, but are not limited to, changes in type, amount, and distribution of precipitation, which directly affects type, abundance and distribution of vegetation. Lower-elevation grasslands and shrub land habitat are expected to become drier and habitat zones shift upward in elevation (Finch 2012). The result of these potential changes could be an increase in suitable cattle forage, thereby causing increased suitable forage for cattle grazing at higher elevations within an allotment.

Another consideration is related to the timeframe of climate change. It is possible for climate change to impact resource use within a short timeframe, which could change the suitability and utilization of forage. For example, there have been periods of increased summer temperature and decreased summer precipitation over a 15- to 20-year planning period, which would indicate that the potential for changes in the suitability and utilization of forage within a grazing allotment may

change within a planning period. This could cause beneficial or negative impacts to the permitted use of a grazing allotment for the suitability and utilization of a grazing allotment.

Though the impacts to grazing from climate change remains to be fully understood or experienced by permittees of the Flathead National Forest, the Forest Service has tools to adapt to unexpected conditions and annual and long-term changes in resource conditions through stocking adjustments and management practices. The impact to livestock grazing could include limited use of allotments and a shortfall of available forage until suitable pasture is available.

3.23.6 Cumulative effects

Spatial and temporal context for effects analysis

The spatial context for this analysis is limited to the existing active allotments within the Flathead National Forest. Additionally, the properties adjacent to the Flathead National Forest were considered in respect to the associated permit-holding ranch operations and potential impacts to open space

Cumulative effects common to all alternatives

This discussion considers impacts from historic livestock use of the Flathead National Forest, to the current Forest Plan through the next planning period. The impacts from historic livestock grazing influences livestock management today. For example, areas that were once heavily grazed or improperly grazed are continuing to recover. Riparian areas altered by livestock uses continue to recover. Fire suppression activities in the past have resulted in conifer encroachment in areas, which, in turn, can limit forage production and availability today, and affect livestock use and distribution patterns.

Based on continuing and increasing public use, it is expected that the impact of recreational uses could increase as the population of local communities increases, and as more people nationwide continue to look for places to recreate. Vegetation management and the use of prescribed fire would likely increase to address vegetative health, fuel loads, and public safety. These trends could result in short-term expenses and long-term benefits to livestock grazing.

Livestock grazing is influenced by the multiple effects described throughout this analysis. These include effects that impact the allocation of forage resources between livestock and wildlife; predation and disease transmission; management adjustments to protect cultural and historical resources; fisheries; threatened and endangered species; water quality; considerations necessary due to wildfire and prescribed fire management, and recreation. All of these factors add to the complexity and expense for the ranching operations that are permitted to graze livestock on the Forest (Rimbey and Torell 2011). Despite all these factors, continued demand and the need for livestock grazing is likely to remain at, or below, current levels. Livestock management is generally considered more difficult on NFS lands than on private lands for many of the reasons previously presented. In addition, the business of livestock management is subject to factors most often not under the control of livestock operators, such as tourism; land values, and potential subdivision of ranches; labor prices and availability; domestic and foreign demand for livestock products, markets and meat prices; Forest Service budgets and farm programs; fuel prices; predator control; social values; and federal policy.

Because of, and in many cases despite of, the effects and unpredictability described above, livestock grazing is expected to continue at, or below, the current permitted level into the future.

3.23.7 Effects determination

Based on the effects analysis, under the no-action alternative and alternatives B, C, and D, the permitted use of the existing grazing allotments would continue. However, temporary spatial and temporal restrictions may potentially restrict access to the grazing allotments, this would limit permitted use.

Under the no-action alternative and alternatives B, C, and D, the suitability and utilization of forage within the grazing allotments would continue to be available for livestock grazing. The availability and access to the available forage would be the limiting factor for livestock grazing. Based on the current condition, it is anticipated that the amount of animal unit months would not increase; thereby limiting potential for increased grazing within the allotments and potential impacts, Project-level evaluation, and consultation, as applicable, would be required to determine the exact extent and magnitude of both beneficial and adverse impacts.

Economic, Social, and Cultural Environment

The following sections are grouped under this heading:

- Cultural and Historical Resources
- American Indian Rights and Interests
- Benefits and Beneficiaries (Social and Economic Environment)

3.24 Cultural and Historical Resources

Cultural resources are defined by the National Historic Preservation Act and by Forest Service Manual 2200, section 2360, as: an object or definite location of human activity, occupation, or use identifiable through field survey, historical documentation, or oral evidence. Cultural resources are prehistoric, historic, or archaeological sites, structures, places, or objects and traditional cultural properties.

Historic properties include cultural sites that reflect past use of the area, having value as defined by the National Register of Historic Places (also known as National Register and Register) Criteria for Eligibility for their: association with important events, association with important people in our history, distinctive historical or architectural style, and potential to provide information about the past. A property can be eligible under one or more of these criteria, and generally are at least 50 years old.

The process includes identifying historic properties through field inventory, evaluating sites for potential inclusion to the Register, and then selecting sites to formally nominate to the Register. Through this process, current and potential impacts to eligible properties are identified and protection measures designed and implemented.

Cultural resources include the entire spectrum of resources for which the Forest Service's Heritage Program is responsible for from artifacts to cultural landscapes without regard to eligibility for listing in the National Register of Historic Places (Forest Service Manual 2360).

3.24.1 Legal and administrative framework

Law and executive orders

National Historic Preservation Act of 1966 (public laws 89-665, as amended, 91-423, 94-422, 94-458 and 96-515)

Section 106: Requires each agency to take into account the effects of its actions on historic properties, prior to approving expenditure of federal funds on an undertaking or prior to issuing any license. Furthermore, an agency must afford the Advisory Council on Historic Preservation (an independent federal agency created by the National Historic Preservation Act) an opportunity to comment on any of the agency's undertaking that could affect historic properties.

36 Code Federal Regulations 800: Provides explicit direction for the identification of sites, the determination of project effects on sites, requirements for consultation with state historic preservation offices, and the Advisory Council on Historic Preservation; and how to develop agreements.

Section 101(a) (8): Gives the Secretary of Interior the responsibility and authority to assess "significant threats" to properties included in, or eligible for inclusion on, the National Register in order to: determine

the kinds of properties that may be threatened; ascertain the causes of the threats; and develop and submit to the President and Congress recommendations for appropriate action.

Section 110 (a) (2) (A): Directs federal agencies to establish "a preservation program for the identification, evaluation, and nomination to the National Register of Historic Places, and protection of historic properties" to "ensure that such properties under the jurisdiction or control of the agency are identified, evaluated, and nominated to the National Register." This would require development of a schedule for the identification, evaluation, and nomination of unrecorded sites.

36 CFR 79: Establishes standards, procedures, and guidelines to be followed by federal agencies to preserve collections of prehistoric and historic material remains and associated records that are recovered in conjunction with federal projects and programs under certain federal statutes. This action should ensure that federally-owned and administered collections of prehistoric and historic materials remains and associated records are deposited in repositories that have the capability to provide adequate long-term curatorial services.

36 CFR 60: Sets forth basic procedures of evaluation and nomination of sites to the National Register of Historic Places, procedures for the operations of state historic preservation officers, and minimum qualification standards for cultural resource professionals.

36 CFR 219.24: Provides guidance for addressing cultural and historic sites in forest plans. Forest planning shall provide for the identification, protection, interpretation, and management of significant cultural resources on NFS lands. Forest planning shall provide an overview of known data relevant to history, ethnography, and prehistory of the area under consideration: including known cultural resource sites; identify areas requiring more intensive inventory; providing for evaluation and identification of appropriate sites for the National Register of Historic Places; providing for establishing measures for the protection of significant cultural resources from vandalism and other human depredation, and natural destruction; identifying the need for maintenance of historic sites on, or eligible for inclusion in the National Register; and identifying opportunities for interpretation of cultural resources for the education and enjoyment of the American Public.

Executive Order 11593 of 1971, Protection and Enhancement of the Cultural Environment, states that the federal government will provide leadership on preserving, restoring, and maintaining the historic and cultural environment of the Nation. Directs federal agencies through federal plans and programs to preserve cultural resources, contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historic, architectural, or archaeological significance. It orders federal agencies to locate, inventory, and nominate to the National Register all properties under their control or jurisdiction that meets the criteria for nomination. It also directs federal agencies to exercise caution during the interim period to ensure cultural resources under their control are not inadvertently damaged, destroyed, or transferred.

Archaeological Resources Protection Act of 1979 (public law 96-95 and 36 CFR Part 7 Section 2a): The Congress finds:

- Archaeological resources on public lands and Indian lands are an accessible and irreplaceable part of the Nation's heritage;
- These resources are increasingly endangered because of their commercial attractiveness;
- Existing federal laws do not provide adequate protection to prevent the loss and destruction of these archaeological resources and sites resulting from uncontrolled excavations and pillage; and

- There is a wealth of archaeological information which has been legally obtained by private individuals for noncommercial purposes and which could voluntarily be made available to professional archaeologists and institutions.

Section 470ii (c): States that "Each federal land manager shall establish a program to increase public awareness of the significance of the archaeological resources located on public lands and Indian lands and the need to protect such resources." It further directs that an annual report of such progress will be submitted to Congress.

Section 470mm: Directs federal agencies to:

- Develop plans for surveying lands under their control to determine the nature and extent of archaeological resources on those lands;
- Prepare a schedule for surveying lands that are likely to contain the most scientifically valuable archaeological resources; and
- Develop documents for the report of suspected violations of this act and establish when and how those documents are to be completed by officers, employees, and agents of their respective agencies.

Native American Graves Protection and Repatriation Act of 1990 (public law 101-601, 25 United States Code 3001-3013) and Regulations 43 CFR Part 10: Addresses the rights of lineal descendants and members of Indian tribes, Alaska Native and native Hawaiian organizations to certain human remains and precisely defined cultural items. It covers items currently in federal repositories as well as future discoveries. The law requires federal agencies and museums to provide an inventory and summary of human remains and associative funerary objects. The law also provides for criminal penalties in the illegal trafficking in Native American human remains and cultural items.

Executive Order 13287 of 2000, Preserve America: Reinforces the federal government policy for "protection and enhancement of America's historic treasures, and to recognize and treat cultural resources as assets. Federal agencies shall advance this policy through the protection of, continued use of, and reinvestment in, the federal government's historic buildings and sites and by conforming to the highest standards of care for, and consideration of, the unique cultural heritage of communities, and of the Nation." Each agency is directed to: (a) review its regulations, management policies, and general operating procedures for compliance with Section 110 of the National Historic Preservation Act, and (b) develop annual goals and measures as part of their compliance with the Government Performance and Results Act (P.L. 103-62) and report annually on the protection of historic and archeological properties within its care. The order also encourages the formation of partnerships with Indian tribes, state and local governments, and the private sector to promote public understanding of the preservation and use of historic properties.

Executive Order 13007, 1996 (Indian Sacred Sites): Directs federal agencies to the extent practicable, accommodate access to and ceremonial use of, sacred sites by Indian religious practitioners while avoiding adversely affecting the sites and maintaining the confidentiality of the sites.

3.24.2 Key indicators

Ground disturbance is a key consideration when determining impacts to cultural resources as ground disturbance may totally or partially expose properties. Adverse impacts to cultural resources can be further exacerbated by interactions with fire, weather events, human actions, and environmental change. The key indicators used in the analysis are shown in table 68.

Table 68. Key indicators for cultural resources

Resource Indicator	Measure
Ground disturbance	Degree of activity or natural condition that poses potential threat to cultural resources
Access to sacred sites	Degree of activity that changes access to sacred sites

3.24.3 Methodology and analysis process

Analysis methods used for historic properties include a review and synthesis of all pertinent literature, records, and documentation available on the history and prehistory of the forests. This information includes not only that which is available from a variety of generalized sources, but also information resulting from several years' worth of Forest Service cultural resource inventories. Information of previously documented sites can be an indicator of the type, frequency, and location of sites likely to be found within the analysis area.

Information sources

Information sources include literature, records, and documentation review and information from Forest Service cultural resource inventories and information from Forest Service archaeologists.

Incomplete and unavailable information

No Forest has been fully assessed for cultural resources; however, many acres have been inventoried. These inventories have occurred generally in areas where there have been management activities in association with vegetation and fuels treatment, recreation development, special uses, and engineering projects. Information is continuously updated in conjunction with completed surveys and research.

Analysis area

The geographic scope of the analysis for cultural resources is the NFS lands of the Flathead National Forest. This area represents the NFS lands where changes may occur from activities that result from the action alternatives.

For cumulative effects, the analysis area also includes the NFS lands in Helena, Kootenai, Lewis and Clark and Lolo national forests for the proposed GBCS amendment and other areas identified for cumulative impact consideration. This discussion is presented in volume 2.

3.24.4 Affected environment (existing condition)

The Flathead National Forest encompasses an area with a long and rich historic and pre-historic heritage record. The earliest evidence of human occupation in the Flathead valley occurs after the last ice age, about 10,000 years ago.

Members of the Salish, Pend d'Oreille, and Kootenai Tribes commonly used and permanently occupied this area. Many other American Indian groups, including the Blackfeet Tribe, traveled through and briefly used the Flathead valley.

Western Montana received some of the earliest European explorers in the Northwest. Shortly after the explorers, the fur trade arrived. David Thompson, a fur trader for the British Northwest Company, came to the Flathead valley in 1809. Trappers and traders traveled along the Flathead River in the 1820s and 1830s. The first settlers arrived in the Flathead valley in the 1850s. Most were former employees from the Hudson's Bay Company and made their living raising cattle, sheep, or trading with American Indians.

By the 1880s, the natural resources of the land were attracting settlers to the area to pursue farming, ranching, and logging. Many settlements were established in the Flathead valley during this period. The construction of railroads around the turn of the century played an important role in the settlement and development of the Flathead valley.

The newly formed Forest Service also played a major role in the history of the Flathead valley. In the early 1900s, its responsibilities included building trail and road systems, overseeing timber harvesting, livestock grazing, mining activities, and suppressing forest fires. The historic district at Spotted Bear and patrol cabins in the Bob Marshall and Great Bear wildernesses are examples of early Forest Service history that have been protected and are eligible for listing on the National Register of Historic Places.

The Flathead National Forest has approximately 350 recorded cultural resources on NFS lands within its boundaries. Of these, the majority (approximately 275) are historic period sites associated with historic Forest Service land management (lookouts, ranger stations ranger cabins, and phone lines), early 20th Century Euro-American farming and mining, and historic logging. The remaining sites (approximately 75) are archaeological sites associated with Native American uses of the land and include lithic scatters, travel routes, Indian scarred trees, and rock art.

Four historic properties, Hornet Peak lookout, the Wurtz homestead, the Stone House on Swan Lake, and Big Creek RS, are listed on the National Register of Historic Places. One historic district, the Flathead National Forests backcountry administrative facilities with 67 contributing buildings, sites, and objects and including the unique, last of its kind in the Nation, grounded return phone line, is also listed in the National Register. A small part of a much larger Blackfeet traditional cultural property located on the Lewis and Clark National Forest overlaps onto the Flathead. There is also the significant aboriginal trail network with more than 30 associated archaeological sites in the South Fork that has been identified by the Confederated Salish and Kootenai Tribes and has been determined eligible for listing on the National Register. An additional 75 heritage properties also have been determined eligible for listing. Addition information about the Flathead's cultural resources can be found in the Flathead Assessment (USDA 2014).

3.24.5 Environmental consequences

Compliance with Section 106 of the National Historic Preservation Act and 36 CFR 800 regulations is required for Forest Service activities and is fulfilled by a process to establish the presence of historic properties within the area of potential effect for each alternative; through background research, State Historic Preservation Office consultation, and an appropriate level of field investigation. When consultation is conducted, , the magnitude of the undertaking, its likely effects, and any alternatives, are taken into account as well as the views of the State Historic Preservation Office/Tribal Historic Preservation Office and other interested parties.

Each forest is require to consult with Native American traditional religious leaders on any project having the potential to affect Native American cultural sites, including burial and ceremonial sites, and practices. Consultation requirements would still apply to any chosen alternative.

Effects to eligible historic properties can be either "no adverse" or "adverse."

- No adverse could include stabilizing a historic property such as controlling erosion of an archaeological site, restoring and maintaining a historic building, or reducing fuels concentrations around a historic property. This kind of treatment is designed and agreed upon through consultation conducted under Section 106 of the National Historic Preservation Act with the State Historic Preservation Officer.

- Adverse effects are impacts to the integrity of the property that destroy a portion of, or the entire, property. A direct adverse impact occurs during the activity itself; such as when a road is built through a historic property and the construction process destroys the site. Indirect adverse impacts are a side effect of the activity or occur after the activity is complete; an example is runoff from a road that eventually erodes a historic property adjacent to it. Adverse impacts can be mitigated or avoided altogether through project design. These mitigation or avoidance measures are agreed to in consultation conducted under Section 106 of the National Historic Preservation Act with the State Historic Preservation Officer and the Advisory Council on Historic Preservation.

Effects to cultural resources are caused by implementing the proposed amendment as well as, and largely uncontrollable, secondary effects such as from public use, potential vandalism, and natural causes (e.g., wind and water erosion). Direct project actions of the action alternatives include those activities that are conducted and controlled by the Forest Service or authorized by Forest Service permits, including timber and silvicultural management, prescribed fire, wildlife and fisheries management, road and trail construction, facilities construction and maintenance, recreation use and management, and special uses authorization to third parties.

Alternative A – no action

The existing forest plan, with permit and/or contract-specific terms and conditions, is the current management being used by the Flathead National Forest to address cultural resources. This direction represents the no-action alternative and is the baseline to which the action alternatives are compared. Thus, it is important to understand what actions would continue under the no-action alternative.

Management direction

Under the 1987 Forest Plan there were no identified historic special interest areas for cultural resources that were afforded special protection and enhancement treatment. Additionally, the current forest plan does not define a MA specific to cultural resources. Current forestwide guidance requires identification, evaluation, nomination, protection, and interpretation of cultural resources. Coordination and consultation with the State Office of Historic Preservation is also required. Sites eligible for listing on the National Register of Historic Places must be evaluated and formally nominated. Protection protocols and mitigation measures are used when cultural resources or sacred sites are inadvertently discovered during project activities. The Flathead's heritage program addresses known and unknown cultural resources and properties and locations of historic significance via management direction in the current plan (USDA 1987).

Indirect effects of the no-action alternative

Under the no-action alternative, identification, evaluation, nomination, protection, and interpretation of cultural resources would continue. Coordination and consultation with the State Office of Historic Preservation would continue. Sites eligible for listing on the National Register of Historic Places would continue to be evaluated and formally nominated to the Register. Protection protocols and mitigation measures would still be used if cultural resources are inadvertently discovered.

Impacts to known and unknown cultural resources and sacred sites under the no-action alternative were considered in reference to the disturbance associated with continuing management and the proposed implementation of the GBCS and are summarized below.

Grizzly bear habitat

Under the no-action alternative, ground disturbance with management activities associated with grizzly bear habitat may result in inadvertent discovery of and/or damage to cultural resources or sacred sites. If

encountered, protection protocols are required and implemented under the no-action alternative to protect and mitigate any impacts to these resources. No impacts to known cultural resources or sacred sites within grizzly bear habitat were identified.

Motorized use and access

Under the no-action alternative, amendment 19 requirements would result in some roads being closed and/or decommissioned (see section 3.11). Long-term unavailability of roads would result in reduced ground disturbance from road use and less potential to encounter or damage cultural resources. Long-term unavailability of roads would also result in less convenient access to areas once easily accessible. Depending on site-specific circumstances, access could require non-motorized travel methods, which may vary travel times by minutes (feet) to hours (miles) depending on the specific locality.

For comparison of alternatives qualitatively, continuance of amendment 19 management is a distinctive feature of the no-action alternative for the Flathead National Forest. Cultural surveys and consultation requirements would still be required and implemented under the no-action alternative during project-level activities such as road decommissioning to protect and mitigate impacts to cultural resources, if encountered.

Recreation

Ground disturbance may result with use, maintenance and construction of existing and new recreation developments. Cultural surveys and consultation requirements would still be required and implemented under the no-action alternative during project-level activities, such as road decommissioning, to protect and mitigate impacts to cultural resources and sacred sites, if encountered.

Alternative B

Management Direction

The primary difference between alternative B and the no-action alternative, as currently implemented, is the addition of objectives that provide performance requirements for the completion of inventories, outreach and interpretive projects, and National Register nomination activities.

Indirect effects

The effects to cultural resources as a result of the alternative B are determined and defined by survey and consultation requirements at the project level. However, to estimate effects prior to consultation, alternative B is contrasted to the no-action alternative to estimate if the alternative increases, decreases, or results in no change to the potential for adverse effects to cultural resources.

The Flathead National Forest's proposed management formalizes current practices, specifically inventory, public outreach, and National Register nomination-related activities. These administrative activities result in no change for potential on-the-ground effects to cultural resources for the Flathead.

There are no direct effects to cultural resources from the proposed GBCS. Effects to cultural resources are indirect by virtue of other programs within Flathead National Forest that implement the GBCS. These effects are summarized below.

Grizzly bear habitat

Ground disturbance with management activities could result in inadvertent discovery of and potential damage to cultural resources or sacred sites within grizzly bear habitat. However, unlike the no-action alternative, some activities (e.g., logging operations) may be temporarily restricted during spring

emergence to avoid grizzly bear disturbance and displacement. This temporary restriction may reduce the potential for ground disturbance that results in inadvertent discovery and damage to cultural resources during the restricted time. However, this reduction may be negligible in contrast to the no-action alternative because the restriction is relatively short-term under alternative B. Regardless, if encountered, protection protocols are still applicable under alternative B to mitigate impacts to cultural resources and sacred sites.

Motorized use and access

To decrease the potential for grizzly bear-human conflicts, the GBSC has requirements to manage road densities to the 2011 baseline and to limit management activities (that may require access and/or motorized use) within the primary conservation area and zone 1 during the spring, when grizzly bears emerge from their dens. This temporary restriction may result in less potential for ground disturbance and less potential for inadvertent discovery of and potential damage to cultural resources during bear emergence or conversely, there may be increased use, and greater potential for ground disturbance, outside of the restricted time period in the same areas. The exact extent and magnitude of this impact is uncertain until site-specific analysis is conducted. During emergence, temporal and spatial restrictions in access and/or motorized use may make certain sacred areas and cultural resources more difficult to access, if accessible at all, for a short time. Access could also require non-motorized travel methods, which may vary travel times by minutes (feet) to hours (miles) depending on the specific locality.

Recreation

Ground disturbance may result in conjunction with construction, use, and maintenance of new recreation developments and cultural resources may be encountered in these areas. However, under the alternative B, and unlike the no-action alternative, the number of new recreation developments is restricted. This restriction would be anticipated to result in a reduction in potential for effects to cultural resources from activities associated with new developments. Regardless, if encountered, protection protocols are still applicable under the action alternatives to mitigate impacts to these cultural resources and sacred sites.

Alternatives C and D

Management direction

Alternatives C and D do not propose management direction specific to cultural resources different than the action alternatives.

Indirect effects of the Alternative C-D

The effects to Cultural Resources under alternative C, D is the same as those presented under the action alternatives.

Consequences to cultural resources from forest plan components associated with other resource programs or revision topics

Effects from fire and fuels management, access and recreation, vegetation management and non-native invasive plant management

Management actions conducted at the site-specific level that result in ground disturbance have the potential for effects to cultural resources and sacred sites. Because these effects are identified, detailed, and disclosed during site specific analysis, the Forest Service has the opportunity to determine appropriate mitigation, avoidance and protection measures. Thus, the consequences to cultural resources from actions associated other programs such as fire and fuels management, access and recreation, vegetation

management and non-native invasive plant management programs are estimated to be minimal and avoidable under all alternatives.

3.24.6 Cumulative effects

The effects that past activities have had on cultural resources were discussed in the "Affected Environment" section and are reflected in the current condition. Therefore, past activities are not carried forward into the cumulative effects analysis.

Cumulative effects include the Flathead National Forest's implementation of the GBCS. The GBCS is being implemented similarly across the Flathead and amendment forests. In these five forests, bear management units within the primary conservation area and zone 1 would have temporary access restrictions during denning season. During denning season it may be more difficult for Native Americans to access sites within these bear management units across all the forests.

3.24.7 Effects determination

Changes to proposed management, outside of implementing the GBCS, are administrative in nature and have no adverse effects to cultural resources.

Ground disturbance associated with implementing alternative B may result in inadvertent discovery of and potential damage to, cultural resources or sacred sites. Protection protocols are in place under all alternatives to mitigate impacts to inadvertent discoveries of cultural resources and sacred sites.

The action alternatives are anticipated to result in less potential for ground disturbance because of limitations for new recreation developments and temporary restrictions to access/motorized use associated with certain roads and project activities in the primary conservation area and zone 1. However temporary spatial and temporal restrictions may potentially adversely impact access to sites of cultural importance in spring, during grizzly bear emergence. Project-level evaluation, and consultation, as applicable, would be required to determine the exact extent and magnitude of adverse effects.

3.25 American Indian Rights and Interests

The Forest Service has obligations under the American Indian Religious Freedom Act of 1978 to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian [Public Law 95-442]. Executive Order 13007 of 1996 further directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting such sites. Consultation with recognized tribal governments is further defined and required by the Native American Graves Protection and Repatriation Act of 1990 [Public Law 101-106], the 1992 amendments to the National Historic Preservation Act, and the 1999 revisions to the implementing regulations in 36 CFR Part 800; Protection of Historic Properties. These obligations are applicable to all management actions no matter where they occur on the forest.

3.25.1 Introduction

The Flathead National Forest provides sustenance to American Indians, protects tribal spiritual values, and helps perpetuate traditional uses and benefits for tribes and other cultures. Native Americans associated with the plan area, existing tribal rights, and areas of known tribal importance are identified in this section. Existing information is used to assess condition and trend of resources that affect tribal rights and areas of tribal importance. Information shared by Tribes at formal meetings and with individuals in conversations provide a rich source of information on tribal perspectives, resource uses, topics of interest, and the unique relationships tribes have with federal agencies.

3.25.2 Legal and administrative framework

Laws and executive orders

The Hellgate Treaty of 1855: The Flathead, Kootenai, and Upper Pend d'Oreilles Indian Tribes reserved rights under the Hellgate Treaty of 1855 (July 16, 1855). These rights include the "right of taking fish at all usual and accustomed places, in common with citizens of the Territory, and of erecting temporary buildings for curing; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land." The federal government has trust responsibilities to Tribes under a government-to-government relationship to ensure that the Tribes reserved rights are protected. Consultation with the Tribes in early phases of project planning helps the Forest Service meet their trust responsibilities.

National Historic Preservation Act of 1966 (Public Laws 89-665, as amended, 91-423, 94-422, 94-458 and 96-515) Regulations 36 Code of Federal Regulations (CFR) Part 800 and 36 CFR 36 CFR Part 7: This act pertains only to tangible properties (buildings, structures, sites, or objects) which are important in history and prehistory. It requires agencies to consider the effects of undertakings on properties eligible to or listed in the National Register of Historic Places by following the regulatory process specified in 36 CFR 800.

The portions of that act that relate specifically to coordination with Indian tribes were added in the 1992 amendments. These additions reflect the increased importance placed on tribal relations. A section of the act directs state and federal governments to assist in the establishment of preservation programs on Indian lands. These sections include:

Chapter 3, section 2: It shall be the policy of the federal government, in cooperation with other nations and in partnership with the state, local governments, Indian tribes, and private organizations and individuals to:

- (2) Provide leadership in the preservation of the prehistoric and historic resources of the United States and of the international community of nations and in the administration of the national preservation program.
- (6) Assist state and local governments, Indian tribes and Native Hawaiian organizations and the National Trust for Historic Preservation in the United States to expand and accelerate their historic preservation programs and activities

National Environmental Policy Act of 1969 (Public Law 91-190) and Regulations 40 CFR 1500–1508: Federal agencies began to invite Indian tribes to participate in forest management projects and activities that may affect them.

National Forest Management Act of 1976 (Public Law 4-588): Directs consultation and coordination of NFS planning with Indian tribes.

American Indian Religious Freedom Act of 1978 (Public Law 95-341 as amended and Public Law 103-344): The Act states that "...it shall be the policy of the United States to protect and preserve for American Indians their inherent right for freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to site, use and possession of sacred objects, and the freedom to worship through ceremonies and traditional rites."

- Agencies must make a good faith effort to understand how Indian religious practices may come into conflict with other forest uses and consider any adverse impacts on these practices in their decision-

making practices. The consideration of intangible, religious, ceremonial, or traditional cultural values and concerns which cannot be tied to specific cultural sites/properties could be considered under American Indian Religious Freedom Act.

Archaeological Resources Protection Act of 1979 (Public Law 96-95) and Regulations 43 CFR Part 7: Establishes a permit process for the management of cultural sites on federal lands which provides for consultation with affected tribal governments.

Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601, 25 United States Code 3001-3013) and Regulations 43 CFR Part 10: Addresses the rights of lineal descendants and members of Indian tribes, Alaska Native, and native Hawaiian organizations to certain human remains and precisely defined cultural items. It covers items currently in federal repositories as well as future discoveries. The law requires federal agencies and museums to provide an inventory and summary of human remains and associated funerary objects. The law also provides for criminal penalties in the illegal trafficking in Native American human remains and cultural items.

Interior Secretarial Order 3175 of 1993: Establishes responsibility of all agencies to carry out trust responsibilities of the federal government and assess the impacts of their actions on Indian trust resources. It requires consultation with tribes when impacts are identified.

Executive Order 12866 of 1993, Regulatory Planning and Review: Enhances planning and coordination with respect to both new and existing regulations. Makes process more accessible and open to the public. Agencies shall seek views of tribal officials before imposing regulatory requirements that might affect them.

Religious Freedom Restoration Act of 1993 (Public Law 103-141): Established a higher standard for justifying government actions that may impact religious liberties.

Executive Order 12898 of 1994: Environmental Justice in Minority Populations and Low- Income Populations directs federal agencies to focus on the human health and environmental conditions in minority and low-income communities, especially in instances where decisions may adversely impact these populations.

Forest Service Tribal Relations Enhancement Act of 2006.

- **Reburial of Human Remains and Cultural Items**: The Native American Graves Protection and Repatriation Act provide for repatriation of human remains and cultural items to lineal descendants and Indian tribes but does not address further disposition of these items. New authority would explicitly authorize the reburial of human remains and associated cultural items on NFS lands, when they were originally recovered from NFS or adjacent lands.

- **Confidentiality of Information**: An increased level of confidentiality would be authorized to protect information relating to reburials, sites, or resources of traditional or cultural importance, including human remains and information relating to traditional and cultural resources and practices provided in the course of research activities.

- **Forest Products for Traditional and Cultural Purposes**: American Indian and Alaska Native tribes have special cultural and traditional needs for forest products located on NFS lands, such as logs and planks for cultural structures. The legislative proposal would create an exception to a National Forest Management Act requirement to sell certain forest products by authorizing the Secretary to provide these products free of charge, when used for traditional and cultural purposes.

- **Access to NFS lands**: The legislative proposal would reinforce the Forest Service's commitment to the American Indian Religious Freedom Act for access to NFS lands.

Executive Order 13007 of 1996, Indian Sacred Sites: This order acknowledges the role of federal agencies to protect and preserve the religious practices and places of federally- recognized tribes and enrolled tribal members. It also requires agencies to consult with federally-recognized tribe to address tribal concerns for sacred sites on public land and to ensure access to religious places and avoidance of adverse effects to sacred sites in accordance with existing legislation.

Executive Order 13175 of 2000, Consultation and Coordination with Indian Tribal Governments: Provides direction for consultation with tribal governments for formulating or implementing policies that have tribal implications. Also provides direction regarding consultation and coordination with Indian Tribes relative to fee waivers. Calls upon agencies to use a flexible policy with tribes in cases where proposed waivers are consistent with applicable federal policy objectives. It directs agencies to grant waivers in areas where the agency has the discretion to do so, when a tribal government makes a request. When a request is denied, the agency must respond to the tribe in writing with the rationale for denial[1].[8]

Executive 13084 of 1998, Consultation and Coordination with Indian Tribes Governments: Calls upon agencies to utilize flexible policy approaches at the Indian tribal level in cases when a proposed waiver is consistent with applicable federal policy objectives. The executive order calls upon agencies to grant waivers in areas where the agency has discretion to do so. This is to be done when a tribal government makes a request; and for those instances where the agency may decline such a request, a reason must be supplied to the tribe.

Code of Federal Regulations

36 CFR 261 Prohibitions in Areas Designated by Order; Closure of National Forest System Lands to Protect Privacy of Tribal Activities (2011): "provides regulations regarding special closures to provide for closure of NFS lands to protect the privacy of tribal activities for traditional and cultural purposes to ensure access to NFS land, to the maximum extent practicable, by Indian and Indian tribes for traditional and cultural purposes".

36 CFR 223.239 and .240 Sale and Disposal of National Forest System Timber, Special Forest Products, and Forest Botanical Products: Section 223.239 provides regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products. Also

[8] Section 2 of this Executive Order states "In formulating or implementing policies that have tribal implications, agencies shall be guided by the following fundamental principles:

- The United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions. Since the formation of the Union, the United States has recognized Indian tribes as domestic dependent nations under its protection. The Federal Government has enacted numerous statutes and promulgated numerous regulations that establish and define a trust relationship with the United States.
- Our Nation, under the law of the United States, in accordance with treaties, statutes, Executive Orders, and judicial decisions, has recognized the right of Indian tribes to self-government. As domestic dependent nations, Indian tribes exercise inherent sovereign powers over their members and territory. The United States continues to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, tribal trust resources, and Indian treaty and other rights.
- The United States recognizes the right of Indian tribes to self-government and supports tribal sovereignty and self-determination."

free-use without a permit upon the request of the governing body of a Tribe. Section 223.240 provides regulations regarding harvest of special forest products by Tribes with treaty or other reserved rights.

3.25.3 Key indicator

The measurement indicator for American Indian Rights and Interests were identified and defined by Tribes through consultation with the Forest Service on the proposed action (alternative B). Consultation provides the opportunity for Tribes to identify potential effects to tribal interests, including to native knowledge, tribally affiliated cultural resources, sacred sites, treaty rights, and religious freedom.

Ground disturbance is a key consideration for effects, as ground disturbance may negatively impact sacred sites and areas. These impacts can be further exacerbated by interactions with fire, weather events, human actions, and environmental change. Access to sacred areas to exercise religious ceremonies and freedoms is another key consideration for effects. Management actions that change access could either beneficially or negatively impact the exercise of treaty rights and expression of religious freedom. Table 69 lists the key indicators that will be used to measure differences among the alternatives.

Table 69. Indicators used to measure differences among alternatives

Resource Indicator	Measure
Disturbance	Degree of activity or natural condition that poses potential threat to sacred sites
Access	Degree of activity or condition that poses potential change to access to areas of Native American interest

3.25.4 Methodology and analysis process

Effects to tribal interests are known only through direct tribal consultation between the Forest Service and affected Tribes. Prior to consultation, effects can only be estimated qualitatively.

Information sources

Land use management plans, heritage reports and information from Forest Service heritage resource specialists, who consult with Tribe members directly are the primary sources of information used for the analysis.

Incomplete and unavailable information

The Forest Service is not aware of all sites and interests of tribal importance. The Forest Service relies on its relationship and consultation with tribes to be informed as to where and what interests may be impacted by Forest Service actions. The consultation process affords both Tribes and the Forest Service opportunities to identify sites, interests and values of tribal importance as well as to identify mitigations and avoidance and protective measures to preserve Tribal interests.

Analysis area

The geographic scope of the analysis for American Indian Rights and Interests is the NFS lands of the Flathead Nation Forest that lie within the GBCS primary conservation area, zone 1 and the Salish demographic connectivity area. This area represents the NFS lands where changes may occur from activities that result from the action alternatives.

For cumulative effects, the analysis area for implementation of the GBCS also includes the NFS lands of the Helena, Kootenai, Lewis and Clark and Lolo national forests and may extend spatially beyond these areas.

3.25.5 Affected environment (existing condition)

The Flathead National Forest is the traditional homeland of the Kootenai and Salish peoples and to a lesser extent, the Blackfeet people. The Confederated Salish and Kootenai Tribes of Montana, which includes the Kootenai, the Bitterroot Salish, and the Pend O'reille Salish peoples, have reserved treaty rights in the plan area under the Hellgate Treaty of 1855. The Blackfeet Tribe does not have reserved treaty rights in the plan area. However, the Blackfeet Tribe has interest in Forest Service activities in the Challenge Creek area because of its proximity to the Badger Two Medicine area of the Lewis and Clark National Forest, an area eligible for listing on the NRHP as a traditional cultural property important to the Blackfeet people. The Flathead National Forest consults with the Blackfeet Tribe on all projects and undertakings that may affect resources of interest to the Blackfeet in the vicinity of the Badger-Two Medicine traditional cultural property.

The Confederated Salish and Kootenai Tribes manage the Tribal Mission Mountains Wilderness that is adjacent to the federally designated Mission Mountains Wilderness on the Forest. The Tribes offer recreation use on some of the tribal lands (recreation permit required) but some tribal lands are reserved for tribal members only.

The Confederated Salish and Kootenai Tribes are contacted in initial project planning stages to advise them on the scope of the undertaking including potential effects, and to make their resource concerns (if any) an official part of the project record. The Flathead National Forest is also in partnership with the Tribes to cooperatively manage the heritage resources in and around Hungry Horse Reservoir.

Sacred sites important to Federally-recognized tribes are managed under Executive Order 13007 (1996) which defines Indian sacred sites as: "Any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of and Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, and Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." Sacred sites are often carefully guarded secrets, even to other tribal members, making their care and management by the Forest Service a challenge.

The Confederated Salish and Kootenai Tribes have expressed concerns regarding Forest activities in the North Fork in areas associated with traditional travel routes and camp locations and with the few graves and rock art sites located on NFS lands in the plan area.

The Blackfeet Tribe has expressed interest in Forest Service activities in the Challenge Creek area because of this area's close proximity to the Badger-Two Medicine area of the Lewis and Clark National Forest, an area eligible for listing on the National Register of Historic Places as a traditional cultural property important to the Blackfeet people. Additional information on this topic can be found in the Flathead Assessment (USDA 2014).

3.25.6 Environmental consequences

The action alternatives represent programmatic decisions; therefore, they would have no direct effects on American Indian Rights and Interests. Potential effects would be considered indirect effects in that they would occur later in time and at the site-specific level.

Alternative A – no action

Management direction for alternative A – no action

Under the 1986 Forest Plan, forestwide guidance requires coordination with Native American Tribes on rights and interest issues and concerns. Specific issues addressed via direction and consultation in the current plan include marked and unmarked burial sites, areas of sacred or religious significance, and the accuracy of portrayals of Native Americans in displays and interpretive sites.

Indirect effects of the no-action alternative

Effects to tribal interests, including native knowledge, tribally affiliated cultural resources, sacred sites, treaty rights, and religious freedom are identified and defined by Tribes through consultation. Under the no-action alternative the Flathead National Forest would continue to meet its obligations to Tribes via consultation requirements.

The action alternatives implementation of the GBCS is anticipated to impact Native American rights and interests associated with grizzly bear habitat, access and motorized use and recreation. The effects of the no-action alternative are presented in the context of these resources and uses for comparison to the action alternatives.

Grizzly bear habitat

Ground disturbance in conjunction with management activities may occur in grizzly bear habitat and sites of Native American interest may be encountered in these areas. However, consultation requirements are required and implemented under the no-action alternative to protect and mitigate impacts to Native American sites within these areas.

Access and motorized use

Under the no-action alternative, and the requirement to meet amendment 19 standards (see section X), ground disturbing activities needed to close and decommission roads could pose a potential impact to American Native interests. Ground disturbance in conjunction with road management, maintenance and/or closure activities and public use of roads may occur and Native American sites may be encountered. However consultation requirements are required and implemented under the no-action alternative during road-related activities to protect and mitigate impacts to Native American sites and access to these sites, if encountered. Access to NFS lands under amendment 19 standards could make some areas, which were previously easily accessible to Native Americans, more difficult to reach as road closures could require non-motorized use, which may increase travel time by minutes (feet) to hours (miles) depending on the specific locality. Details of site-specific effects would be disclosed and discussed during consultation.

Recreation

Ground disturbance may occur in conjunction with recreation use and facilities and Native American sites may be encountered in these areas with these activities. However, consultation requirements are required and implemented under the no-action alternative to protect and mitigate impacts to Native American sites if encountered.

Alternatives B, C, and D

Management direction for alternative B

In addition to adopting relevant direction from the GBCS, the actions alternatives B, C, and D includes direction specific to the Forest Service's heritage program. With regard to the later, the action alternatives

desired conditions, objectives and guidelines expand upon the current protections in place for areas of tribal importance with more specific and detailed language than what was used in the Flathead's 1986 forest plan.

Effects of forestwide, MA and GA direction

The effects to tribal interests as a result of the action alternatives are determined and defined by Tribes and disclosed by the Tribes to the Forest Service during consultation. To estimate effects prior to consultation, the action alternatives are contrasted to the no-action alternative to see if the alternative increases, decreases, or results in no change to the potential for adverse effects to American Indian Rights and Interests.

Outside of the implementation of the GBCS, the difference between the action alternatives and the no-action alternative, as currently implemented, is the addition of specific objectives to establish a tribal consultation protocol and complete formal management plans. The action alternatives also uses more detailed language to articulate protections already afforded to the Tribes under the no-action alternative.

Thus, the action alternatives represents no direct change to current management, but does propose additional administrative activities, a consultation protocol and formalized management plans. It is anticipated that administrative activities that focus on improving communications and planning activities between the Tribes and the Forest Service would result in a decrease to the potential for adverse effects to Tribal interests.

The action alternatives to implement the GBCS is anticipated to impact Native American rights and interests associated primarily with grizzly bear habitat, access and motorized use and recreation. The effects of the no-action alternative are presented in the context of these resources and uses for comparison to the action alternatives.

Grizzly bear habitat

Ground disturbance in conjunction with management activities proposed under the GBSC for the Flathead National Forest may still occur in grizzly bear habitat, which may also be in areas with Native American interests on amendment forest NFS lands. However, consultation requirements would still be required and implemented under the action alternatives to protect and mitigate impacts to these interests.

Access and motorized use

To decrease the potential for grizzly bear-human conflicts, the GBSC has restrictions managing road densities to the 2011 baseline and limiting management activities within the primary conservation area and zone 1, such as motorized use of roads during the denning season. In contrast to the no-action alternative, these restrictions are expected to result in less ground disturbance and less potential for impacts to physical sites of Native American interest. However, restrictions to use of roads may make certain areas temporarily more difficult to reach and require non-motorized travel methods, which may vary travel times by minutes (feet) to hours (miles) depending on the specific locality.

Recreation

Ground disturbance may still occur in conjunction with recreation use and facilities and Native American sites may still be encountered in these areas with these activities. Implementing the GBCS has restrictions in time and place for new recreation developments. These restrictions may decrease the potential for impacts over the no-action alternative to American Indian Rights and Interests. Consultation requirements would still be required and implemented under the action alternatives alternative to identify, protect and mitigate impacts to Native American sites and interests.

Alternatives C and D

Management direction for alternatives C, D

No management direction different from the alternative B is proposed under alternatives C and D.

Effects of forestwide, MA and geographical area direction

The effects to tribal interests are defined by Tribes and disclosed by the Tribes during consultation. Current management direction and requirements for consultation have been designed to ensure that areas on NFS lands, which are important to Native Americans, are not inadvertently impacted by the Forest Service under alternatives C and D. Because the management direction for the Plan Revision, including the implementation of the GBCS, is the same for alternatives C and D with respect to American Indian Rights and Interest as to the action alternatives, the effects of these alternatives are the same as those disclosed under the action alternatives.

Consequences to American Indian Rights and Interests from forest plan components associated with other resource programs or revision topics

Effects from fire and fuels management, access and recreation, vegetation management and non-native invasive plant management.

Management actions conducted at the site-specific level that result in ground disturbance have the potential for effects to American Native sites and interests. Because these effects are identified, detailed, and disclosed by Tribes during consultation, the Forest Service and Tribes have the opportunity to work together to determine appropriate mitigation, avoidance and protection measures. Thus, the consequences to American Indian Rights and Interests from actions associated with fire and fuels management, access and recreation, vegetation management and non-native invasive plant management programs are estimated to be minimal and avoidable through consultation under all alternatives.

3.25.7 Cumulative effects

The effects that past activities have had on American Indian Rights and Interests were discussed in the "Affected Environment" section and are reflected in the current condition. Therefore, past activities are not carried forward into the cumulative effects analysis.

The action alternatives (and action alternatives) represents no direct change to current management of American Rights and Interests, outside of the addition of a consultation protocol and formalized management plans. As administrative, documentation-related activities, there are no cumulative effects.

Cumulative effects associated with the implementation of the GBCS includes the NFS lands of the Helena, Kootenai, Lewis and Clark and Lolo national forests are discussed in volume 2 of the environmental impact statement.

3.25.8 Effects determination

The no-action alternative may result in adverse impacts via a reduction in access to NFS lands via amendment 19 requirements. The action alternatives are anticipated to result in less overall ground disturbance because of limitations for new recreation developments and temporary restrictions to motorized use of certain roads in conjunction with 2011 baseline requirements. However the latter restriction may also adversely affect access for Native Americans to sites during grizzly bear den emergence. Consultation would still be required to definitively determine if adverse effects do exist and if mitigations are possible. The action alternatives similar direction to implement a consultation protocol

and complete management plans would be expected to result in beneficial effects to the working relationship between the Tribes and the Forest Service.

3.26 Benefits and Beneficiaries (Social and Economic Environment)

3.26.1 Introduction

The mission of the Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. Flathead National Forest lands both influence, and are influenced by, local and national publics. Local communities, particularly those adjacent to national forest lands, benefit from a multitude of goods and services provided by the Forest and the Forest Service. These societal benefits are often referred to as ecosystem services, which are defined "as goods and services provided wholly or in part by ecosystems and that are of value to people" (Olander et al. 2015). The Forest's ecosystem services, alongside infrastructure and operations, are the main ways that public lands contribute to social and economic sustainability. Many local communities were formed based on availability of roads and ecosystem goods and services such as timber, gold, silver, grazing lands, and other natural resources. Historically, individuals in these communities have benefited from a host of services such as recreation, scenery, employment, and opportunities to connect with nature. The general public across the U.S. also benefit from the Flathead National Forest (Forest). These benefits include: clean air, clean water, conservation of old growth forests, grizzly bears, or other threatened and endangered species.

The 2012 planning rule states that plans are to guide management so that forests and grasslands contribute to social and economic sustainability, providing people and communities with ecosystem services and multiple uses that provide a range of social, economic, and ecological benefits for the present and into the future. Specifically, plan components must include standards or guidelines to **guide the plan area's contribution to social and economic sustainability**, taking into account ecosystem services as well as multiple uses that contribute to local, regional, and national economies and communities in a sustainable manner. Furthermore, reasonably foreseeable risks to societal benefits shall be considered when developing the Forest Plan.

This subchapter, therefore, (1) describes the social and economic conditions of the affected environment using key indicators of social and economic sustainability; (2) describes how key benefits of the Forest currently contribute to social and economic sustainability of beneficiaries, both locally and at a broader scale (3) evaluates the impacts of the proposed Forest Plan (henceforth 'alternative B') and alternatives A,C and D on the benefits the Forest provides to local beneficiaries and the general public.

3.26.2 Legal and administrative framework

The following is a select set of statutory authorities that govern the evaluation of social and economic resources in the plan area. They are briefly identified/described below to provide context to the management and evaluation of the resource. There are multiple other laws and regulations and policies not described below that also guide the management of this resource.

1. The evaluations of social and economic resources are framed within the context of sustainability because, in accordance with the 2012 National Forest System Land Management Planning Rule (36 CFR 219), Forest Plans are to guide management so that forests and grasslands are ecologically sustainable and contribute to social and economic sustainability.

2. The Agency 2012 planning process leads to plans that contribute to ecological, social, and economic sustainability by protecting resources on the unit to maintain a flow of goods and services from NFS lands on the unit over time.

Portions of the 2012 Planning Rule that specifically relate to social and economic resources include: "Contribute to ecological, social, and economic sustainability by ensuring that all plans will be responsive and can adapt to issues such as the challenges of climate change; the need for forest restoration and conservation, watershed protection, and species conservation; and the sustainable use of public lands to support vibrant communities." "Social sustainability" refers to the capability of society to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another and support vibrant communities, and "economic sustainability" refers to the capability of society to produce and consume or otherwise benefit from goods and services including contributions to jobs and market and nonmarket benefits. . . (36 CFR 219.19).

§ 219.8 Sustainability. The plan must provide for social, economic, and ecological sustainability within Forest Service authority and consistent with the inherent capability of the plan area, as follows:

(b) Social and economic sustainability. The plan must include plan components, including standards or guidelines, to guide the plan area's contribution to social and economic sustainability, taking into account:

1) Social, cultural, and economic conditions relevant to the area influenced by the plan;

2) Sustainable recreation; including recreation settings, opportunities, and access; and scenic character;

3) Multiple uses that contribute to local, regional, and national economies in a sustainable manner;

4) Ecosystem services;

5) Cultural and historic resources and uses; and

6) Opportunities to connect people with nature. (36 CFR 219.8)

7) Reasonably foreseeable risks to ecological, social, and economic sustainability. (36 CFR 219.10 (a)).

The rule states that the plan must also be consistent with laws and executive orders including:

Multiple-Use Sustained Yield Act of 1960: Identifies principles for managing the resources of the NFS. The direction to manage these resources for the greatest good over time includes the use of economic and social analysis to determine management of the NFS.

National Environmental Policy Act of 1969: Mandates consideration of the consequences to the quality of the human environment from proposed management actions. The agency must examine the potential impacts to physical and biological resources as well as potential socioeconomic impacts (40 CFR 1508.14).

Forest and Rangeland Renewable Resources Planning Act of 1974: As amended by the NFMA of 1976, requires consideration of potential economic consequences of land management planning.

Office of Management and Budget Circular A-116 (issued August 16, 1978): Requires executive branch agencies to conduct long range planning and impact analysis associated with major initiatives.

Executive Order No. 12898 on Environmental Justice (issued February 11, 1994): Mandates federal agencies to make achieving environmental justice part of their mission. This includes identification and response to disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

National Forest Revenue Act (amended 1908): Requires 25 percent of revenues generated by NFS lands to be paid to the States for use by the counties in which the lands are situated for the benefit of public schools and roads.

Secure Rural Schools and Community Self-Determination Act of 2000: Was designed to stabilize annual payments to state and counties containing NFS lands and public domain lands managed by the Bureau of Land Management. Funds distributed under the provisions of this act are for the benefit of public schools, roads, and related purposes.

3.26.3 Evaluation framework: economic and social benefits

Introduction

Economic and social benefits of the Forest are measured by identifying how ecosystem services, infrastructure and operations, and multiple uses contribute, either directly or indirectly, to economic and social sustainability. Specifically, ecosystem services are those societal benefits the forest provides, including both goods and services, that are of value to people. Infrastructure and operations benefits include both physical structures such as facilities, as well as, all the services the Forest staff provide such fire suppression.

The Forest Service also manages NFS lands according to the principle of multiple use. This principle allows the agency to manage land for a variety of uses, including amenity, commodity, non-commodity, and recreation. The Multiple-Use Sustained-Yield Act (P.L. 104–333) formalized this management philosophy, stating that the Forest Service is to manage resources to best meet the needs of the American public, with flexibility to provide for “periodic adjustments in use to conform to changing needs and conditions” (Section 4(a) of the Act [16 U.S.C. 531]). For instance, areas suitable for timber production may contribute to the local economy by sustaining timber sector jobs and income; thereby maintaining social fabric and lifestyles of the community. Wilderness areas also generate significant social and economic well-being by providing world-class recreational settings. Visitors from near and far may benefit from experiencing solitude in these pristine locations; while contributing to the regional economy (i.e. travel and tourism related sectors) in terms of jobs, income and other economic activities.

Economic and social sustainability

Numerous approaches exist for measuring society’s condition or progress towards achieving social and economic sustainability. In the forest planning context, a broad ecosystem services framework, which catalogues societal benefits of forests, is an ideal framework for identifying how the plan area contributes to social and economic sustainability.

Societal benefits of the Forest are used and/or valued differently by different groups and communities. To get a clearer understanding of which services are most valued by beneficiaries and contribute most to social and economic sustainability, the Assessment provided an in-depth study of social and economic conditions, local community values and beliefs. In the affected environment section, we synthesize the information collected on social, cultural and economic conditions to identify the key societal benefits the Forest provides to beneficiaries.

3.26.4 Key indicators

The societal benefits identified in the Flathead Assessment are listed in table 70. Each benefit is categorized by the type of contribution to social and economic sustainability. These contributions are divided into three main categories: income, jobs and quality of life. Quality of life is sub-divided into three sub-categories: well-being, health and safety and traditional/cultural/spiritual values. These categories are not mutually exclusive. Some indicators fall under more than one category. For example, outdoor recreation contributes to income, jobs, and quality of life.

Table 70. Contribution to social and economic sustainability

Key Forest Benefit to Society	Income	Jobs	Well-being	Health and Safety	Traditional, Cultural, Spiritual values
Water quality and quantity				X	
Clean air – particulate matter /haze				X	
Inspiration – spiritual values and solitude					X
Cultural/heritage values					X
Carbon sequestration and climate regulation				X	
Flood control				X	
Forest products/Veg Management/Forage	X	X			X
Outdoor recreation	X	X	X	X	X
Scenery	X		X	X	X
Fish and Wildlife	X	X			X
Research/Education			X	X	X
Other Income/jobs(PILT, indirect, induced, income/jobs)	X	X	X		
Direct Income and Jobs (FS employment and contractors)	X	X		X	
Fire Suppression	X	X		X	

Ecosystem services indicators

Key ecosystem services were identified in the Forest Assessment. Most of these services, and their corresponding indicators, are described in greater detail in the given resource chapter. Below is the complete list of services. Key ecosystem services that fall under the multiple use description are listed under the multiple use section. The following represent key ecosystem services:

- Water quality and quantity
- Clean air – particulate matter, scenic quality/haze
- Inspiration – spiritual values and solitude
- Cultural/heritage values
- Carbon sequestration and climate regulation

- Flood control.

Multiple use indicators

Key multiple uses are included in detail in the given resource chapter. Below is the list of key multiple uses. For more detailed description of each use, please refer to the relevant resource chapter. The following represent key multiple uses:

- Forest products/Vegetation management/forage (details in the Forest Products section, 3.21)
- Outdoor recreation (details in the Recreation section, 3.9)
- Scenery (details in the Scenery section, 3.10)
- Fish and wildlife (details in the Wildlife, 3.6. and Aquatics, 3.2, sections).

Operations and Infrastructure

The Forest Service staff, management, and infrastructure also contribute to social and economic sustainability. Key infrastructure and operations contributions include:

- Direct income and jobs (Forest Service employees, contractors, etc.)
- Other income and jobs (payments in lieu of taxes, indirect income/job, induced income/jobs)
- Research/Education (details in the Research Natural Area, 3.19, and Recreation, 3.9, sections)
- Fire suppression (details in Fire, 3.7, section).

3.26.5 Methodology and analysis process

To analyze the impacts of the alternatives on contributions to social and economic sustainability, first we identified the key benefits provided by the plan area. In the affected environment section, we describe the condition of income, jobs and quality of life of local beneficiaries. Then we describe how the societal benefits the Forest provides contribute to the income, jobs and/or quality of life of local beneficiaries, and the general public. Some indicators are easier to quantify than others. Jobs and income data are provided when available.

Less quantifiable measures of quality of life, such as well-being or cultural values, are discussed qualitatively. Information provided in the Affected Environment is drawn mainly from part 2 of the Assessment. The Assessment documented various data sources, methodologies and modeling assumptions used throughout this analysis, for example, sources of socioeconomic data (p .3) and the economic contribution input-output model (p. 82).

3.26.6 Affected environment (existing condition)

Introduction

Different segments of the public have different connections to the land as well as interests, culture and values. Communities characterized in terms of geographical boundaries are placed-based (people who live, work, or play in the same general locality); while communities characterized according to shared interest, passion, culture and values transcend geography, and can be regarded as ‘communities of interests’ (Patterson et al. 2003).

The distinction between place and interest is not mutually exclusive. In fact, many communities share location and values, beliefs, and attitudes (because community members choose to live near like-minded people, or due to the historical development of natural resource-dependent communities as described in the beginning of this report); while it is equally plausible that people with different or opposing viewpoints reside in the same locality.

Considering the overlapping values of different communities, this analysis does not try to parse out individual communities but rather takes a more holistic approach by examining the societal benefits the forest provides to all types of beneficiaries.

Beneficiaries are those who derive specific, local, placed-based benefits such as employment, income, scenic views or connection to scared sites, as well as those who benefit from the forest more broadly, such as those who value the grizzly bear and benefit from the forest's ability to provide safe habitat for the grizzly bear.

Beneficiaries are those in the local communities as well as those in other counties, states and nations. For example, residents of Missoula County benefit from recreation services on the Forest and are therefore, taken into consideration as beneficiaries of recreation. Similarly, national and international beneficiaries are included as recipients of the societal benefit of carbon sequestration and climate regulation.

Uses, products, services and visitor opportunities supported by National Forests produce a steady flow of benefits which contribute to the social and economic sustainability of both forest dependent communities and the general public. This framework of societal benefits provides unique opportunities to explore the linkages between people and the Flathead National Forest that may transcend a geographically defined community.

Local beneficiaries

While beneficiaries exist in all geographies, this report takes care to describe in more detail the social, cultural and economic conditions of the geographic areas most closely tied to, and impacted by, the Forest. The land administered by the Forest is spread among six counties in Montana: Flathead, Lake, Lewis and Clark, Lincoln, Missoula, and Powell.

After a detailed look at commuting patterns, timber processing areas, and recreational visitation, it was determined that the area of influence (hereinafter called the analysis area) for the social and economic analysis would consist of four counties in northwestern Montana that are adjacent to, or in the immediate vicinity of the Forest: Flathead, Lake, Lincoln, and Sanders. Although recreation ties suggest the inclusion of Glacier County, the extremely light commuting from Glacier County to the other affected counties led us to exclude Glacier County. Lincoln County, on the other hand, is included due to both substantial commuting across county lines and also some timber processing of Forest timber products in Lincoln County. Both Sanders and Lake Counties were included because of commuting, trade and travel corridors across these counties. Even though Missoula County does process timber harvested from the Forest and does contain Flathead NFS land, it was not included in the impact area because it is a Metropolitan Statistical Area, and the size of its economy would tend to mask the impacts on the other affected counties. Lewis and Clark and Powell counties were not included due to the light commuting from these counties and only weak economic ties to the rest of the counties in the analysis area. The geographical relationship of the Forest to the analysis area counties is shown in figure 4.

Demographic information on local beneficiaries provides insight into the social and economic conditions of the affected environment. It also provides a backdrop for understanding how different members of society may be benefitting from the forest and which services they value most. The data below provide insight into the beneficiaries of the Forest. Beneficiaries are heterogeneous, ranging in age, income,

race/ethnicity, educational attainment, employment rate, industry, health, cultural values, priorities and spiritual beliefs.

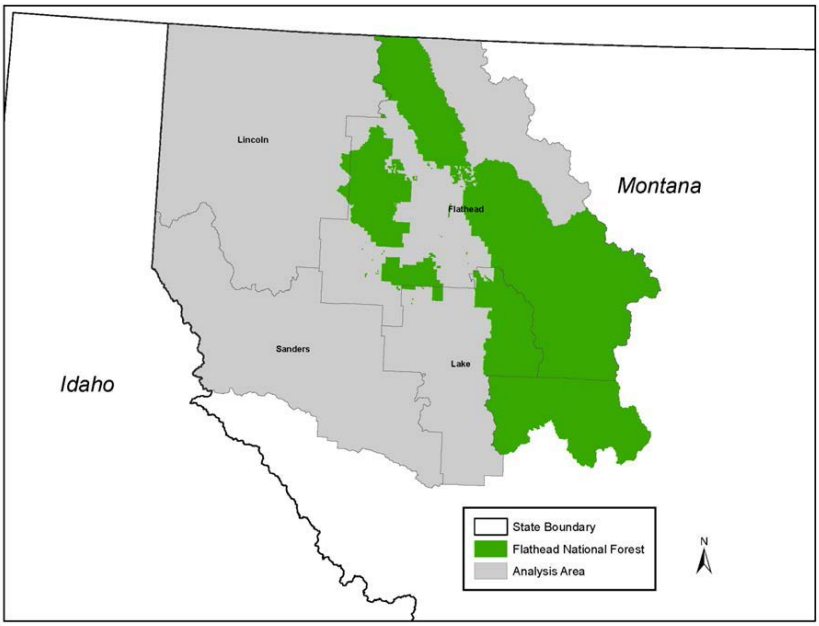


Figure 4. Counties in the analysis area

The largest county, by land area, is Flathead County, with 5,088 square miles (mi^2). The smallest is Lake County, with 1,490 mi^2. The majority (71 percent) of the forest is within Flathead County, which has more than 1.7 million acres of Flathead NFS land. While a fraction of forested land in Flathead County is administered by the Kootenai National Forest, the bulk of forested lands is administered by the Forest. Lincoln County also has a substantial amount of NFS land; however, the majority of that land is administered by the Kootenai National Forest. Larger towns in Flathead County include Kalispell, Columbia Falls, Bigfork, Whitefish, and other smaller towns and Census-designated places. Lake County includes Polson, St. Ignatius and Pablo. Sanders County includes Thompson Falls, Noxon, and Trout Creek. Lincoln County includes Libby, Troy, and Eureka.

Population demographics

From 1990 to 2011, the four-county area saw a 90 percent increase in population – from 79,485 to 151,254 people. In comparison, the overall United States population increased by 53 percent during the same period. In the more recent period of 2000 to 2011, the analysis area's population grew by 16 percent, and 79 percent of that increase came from migration into the area. People are choosing to move into the area. Flathead County has the largest population (91,301 in 2011) and witnessed the largest positive annual net migration between 2000 and 2012 (US Department of Commerce 2012). Looking at the population change by census tract, it is clear that Flathead County has experienced the most significant growth in the past decade (see figure 5).

The Northwest Economic Development District Regional Comprehensive Economic Development Strategy, which serves all four counties (2007) notes the recent sustained growth has been placing a considerable financial burden on government entities who are struggling to provide the necessary infrastructure and emergency services for the influx of new residents, as well as maintain and upgrade current facilities. The Strategy also found that the population growth occurring in the four counties increases the residential density along the forest edge, which has consequences on riparian and

environmentally sensitive areas, use of recreational facilities, fire suppression and forest management in general.

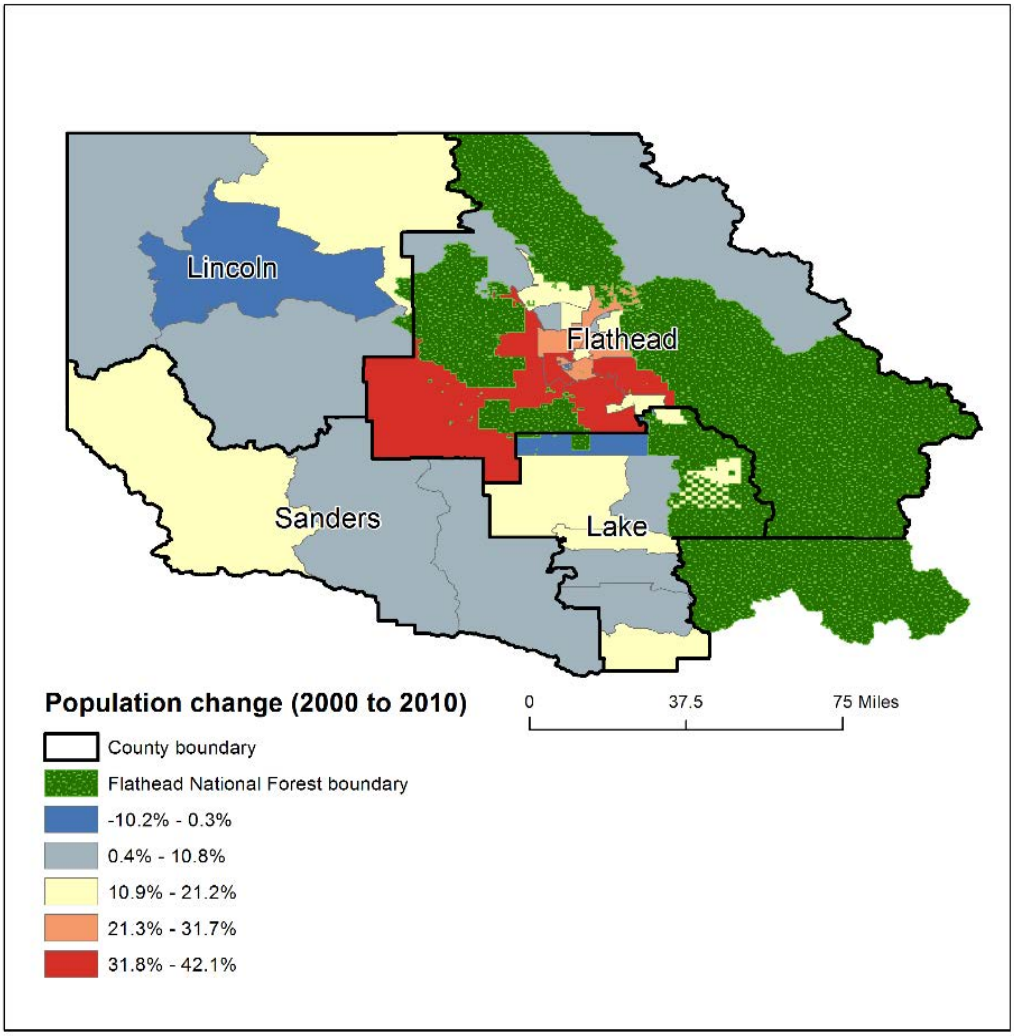


Figure 5. Population change in counties in the analysis area (2000–2010)

Map Source: US Forest Service, Region 1. 2015. Data Source: US Census. Population by census tract, 2000 and 2010.

The Forest Service's 2010 Renewable Resources Planning Act (RPA) Assessment projected county-level population change through year 2060 (Zarnoch et al. 2010). The average population of the four-county area is projected to increase 39 percent from 2010-2035 and 37 percent from 2035-2060. Again, with Flathead County leading the pack (52 percent from 2010-2035 and 45 percent from 2035-2060).

Figure 6 displays the distribution of the population by census tract. The population in the study area is not evenly distributed across counties. Census tracts closest to the Flathead National Forest tend to be more densely populated.

The racial composition of counties also varies considerably (see figure 7.). The Flathead Indian Reservation is located in Lake and Sanders counties. Census tracts within reservation boundaries tend to have the highest concentrations of Native Americans of any area across the study region (over 20 percent Native Americans).

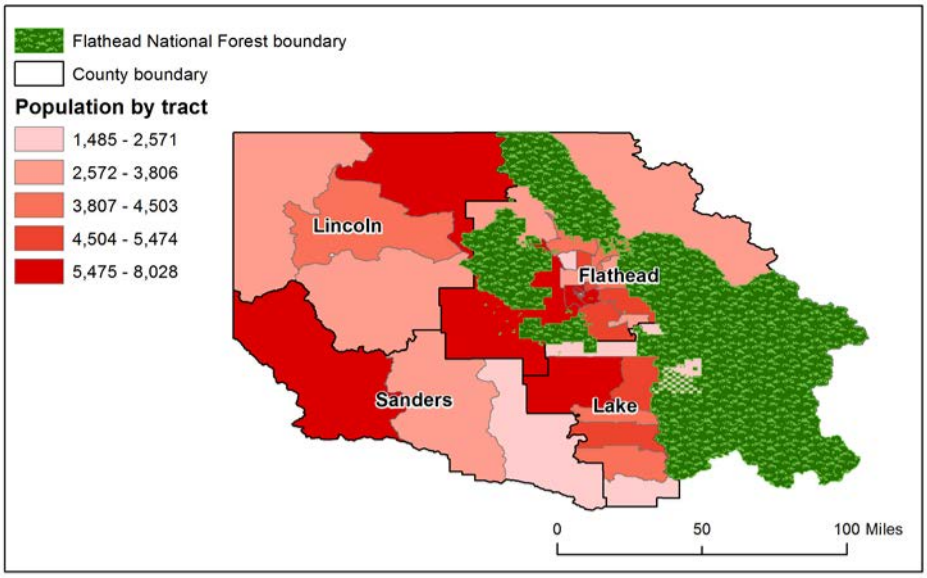


Figure 6. Population by census tracts in the analysis area (2009–2013)
Source: The data in the map are from the U.S. Census ACS, 2013 five-year tables.

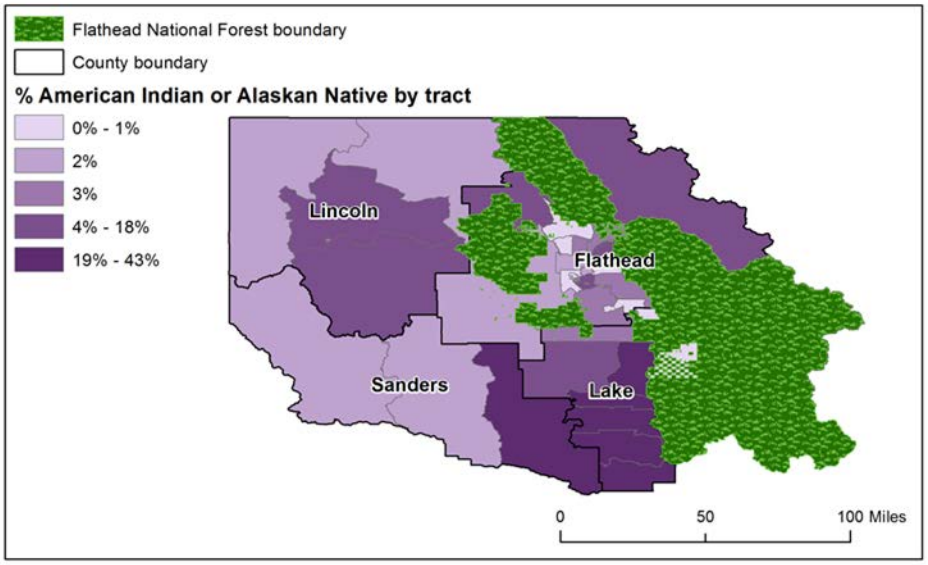


Figure 7. Native American population by census tracts in the analysis area (2009–2013)
Source: The data in the map are from the U.S. Census ACS, 2013 five-year tables.

Table 78 below charts the racial makeup of each county. Lake County has a high percentage of American Indians, figuring at 22 percent of the county's population. This is a significant percentage as the County Region figures only at 5.7 percent. Lake County also has a much higher percentage of American Indians than the State of Montana at 6.2 percent. Much of the Confederated Salish and Kootenai Tribes Indian Reservation is located in Lake County, with portions also in Sanders, Flathead and Missoula Counties, and the Confederated Salish and Kootenai Tribes Tribal Government and Council is headquartered in Pablo. Sanders County has 5.6 percent of the population being American Indian. This is similar to the

State's population percentage of 6.2. Flathead, Lincoln and Sanders Counties have little ethnic diversity, and they have a higher percentage of "White alone" than the State.

Table 71. Total population, and percent of the total population by race, 2011*

Population	Montana	Flathead Co.	Lake Co.	Lincoln Co.	Sanders Co.	County Region	US
Total Population	**982,854**	**90,317**	**28,628**	**19,574**	**11,421**	**149,940**	**306,603,772**
White alone (%)	89.7	95.8	70.6	96.2	92.0	90.8	74.1
Black or African American alone (%)	0.4	0.2	0.2	0.1	0.2	0.2	12.5
American Indian alone (%)	6.2	1.3	22.0	2.1	5.6	5.7	0.8
Asian alone (%)	0.6	0.5	0.5	0.4	0.2	0.5	4.7
Native Hawaiian & Other Pacific Is. alone (%)	0.1	0.0	0.0	0.0	0.0	0.0	0.2
Some other race alone (%)	0.6	0.3	0.1	0.1	0.3	0.3	5.1
Two or more races (%)	2.3	1.8	6.6	1.0	1.6	2.6	2.5

Source: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.[Accessed via EPS-HDT] * The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

The age structure of the population is also relevant to land management decisions, as people of different ages tend to use national forests in different ways. For example, some people have shared that they have changed from non-motorized activities to motorized as they have aged (ch. 2, Flathead Assessment). From 2000 to 2011, the analysis area has experienced a mild aging of the population. The percent of residents 65 and over increased from 13.9 to 15.8 percent and the percent aged 45–64 jumped from 27.0 to 31.6 percent. This trend is consistent with the United States population as a whole. As the "baby boomer" generation (those born between 1946–1964) transitions into the older age brackets, the age structure of the population becomes more top-heavy (see p.24–25 in the Flathead Assessment, Part 2: Process and Methods).

Table 72. Age distribution of residents in analysis area, 2000 and 2011

Age Category	2000	% of Total population	2011	% of Total population
Total Population	**130,042**	**-**	**149,940**	**-**
Under 18	33,932	26.1	34,769	23.2
18-34	22,357	17.2	27,018	18.0
35-44	20,564	15.8	17,153	11.4
45-64	35,099	27.0	47,318	31.6
65 and over	18,090	13.9	23,682	15.8

Source: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C. [Accessed via EPS-HDT] * The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

This phenomenon of an aging population is not evenly distributed across the study area. Census tracts farther away from Flathead National Forest boundaries tend to have the highest percentage of residents 65 and over, save the northeastern region of Lake County (see figure 8). The aging of the study area

population is significant as it could indicate an increasing demand for recreation services in general, and motorized activities and developed areas in particular. With a larger portion of the population entering retirement, residents may have more leisure time available for recreating on Forest Service lands.

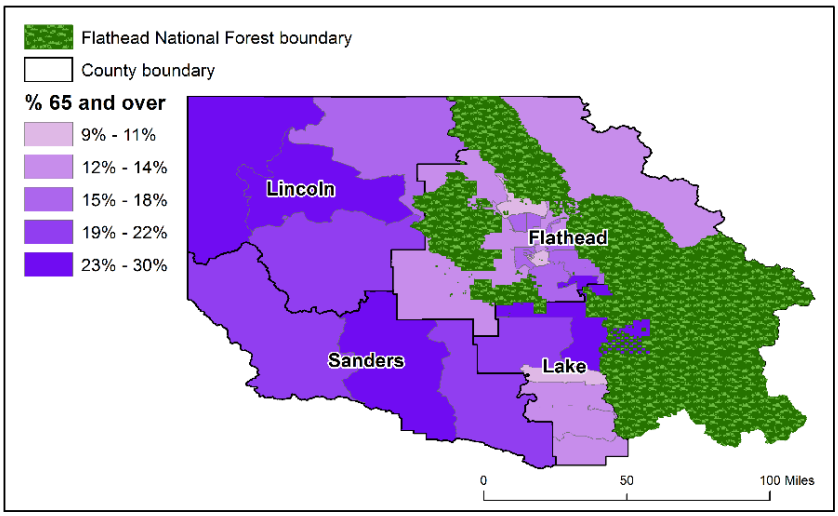


Figure 8. Percent of population, 65 and over, by census tract.
Source: The data in the map are from the U.S. Census ACS, 2013 five-year tables.

Economy

Due to varying economic landscapes between counties, the economic picture in the analysis area is most accurately described at the county level. The largest of these counties, Flathead County, provides for the largest population and important population center, Kalispell/Columbia Falls/Whitefish (figure 9). Compared to the rest of the region, Flathead County offers greater economic opportunities with diversified industries, and higher earnings per capita income. Sanders and Lincoln County, conversely face higher rates of unemployment, lower earnings per job, and a high level of non-labor income from aging and hardship payments. Lake County falls somewhere between Flathead and the other two counties in that measurements here will capture the counties more unique mixture of demographics, and economic activity.

Overall conditions in the analysis area lag behind national averages. Lower income levels and higher unemployment are among some of the more concerning data reported from this region. Flathead County had the highest per capita income in 2014, at $38,982, 16 percent lower than the U.S. average of $46,049. Lincoln, Sanders, and Lake County recorded per capita incomes at more than 30 percent lower than the national average. Unemployment was also higher than national averages for Lincoln and Sanders County (figure 10). Lincoln County recorded the highest unemployment rate in 2015 at 11.3 percent.

Additional economic concerns are raised by higher non-labor personal income data, which is much higher in this region, at nearly 50 percent of recorded total personal income (figure 11). Non-labor personal income comes from three sources, investment, age, and hardship related payments. In the West, non-labor personal income is most often higher in rural counties, where fewer, and less diverse opportunities for labor income exist. In the strongest metro-area economies, non-labor personal income is observed at or below 20 percent, and in the more challenged of rural economies, non-labor personal income rises above 50 percent. Across the analysis area, Flathead County stands out with dividends interest, and rent income making up a higher percent of non-labor personal income (24–48 percent of total), and in the other three

counties age and economic hardship related payments are of a greater percentage makeup of non-labor personal income .[9]

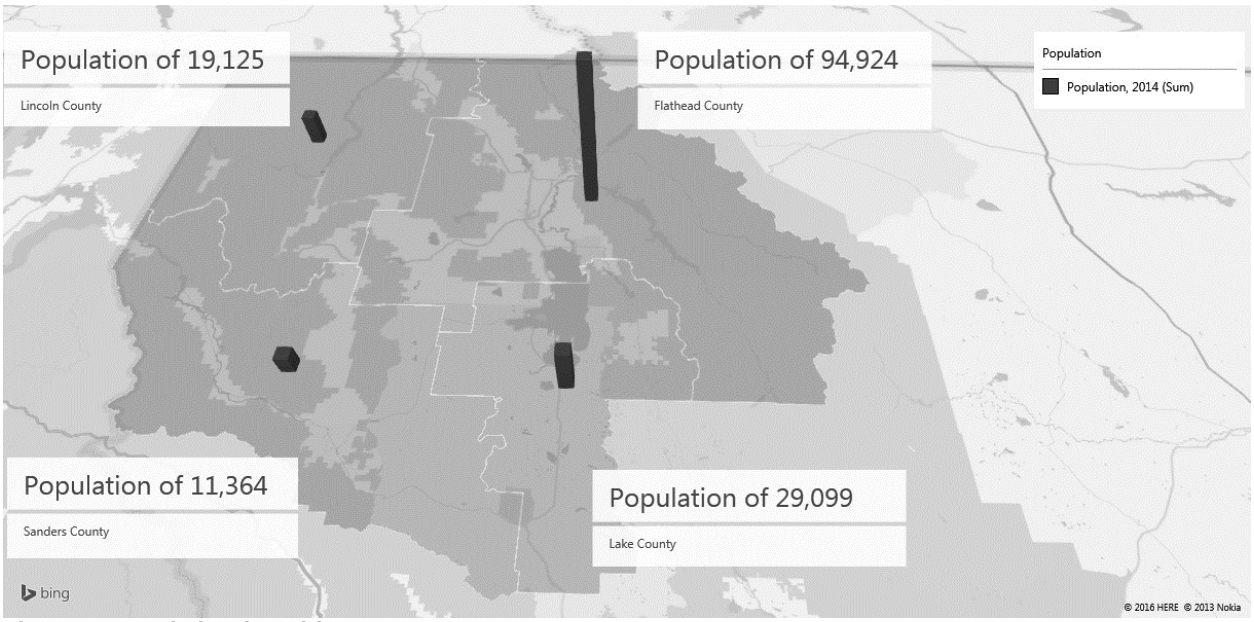


Figure 9. Population (2014) by county

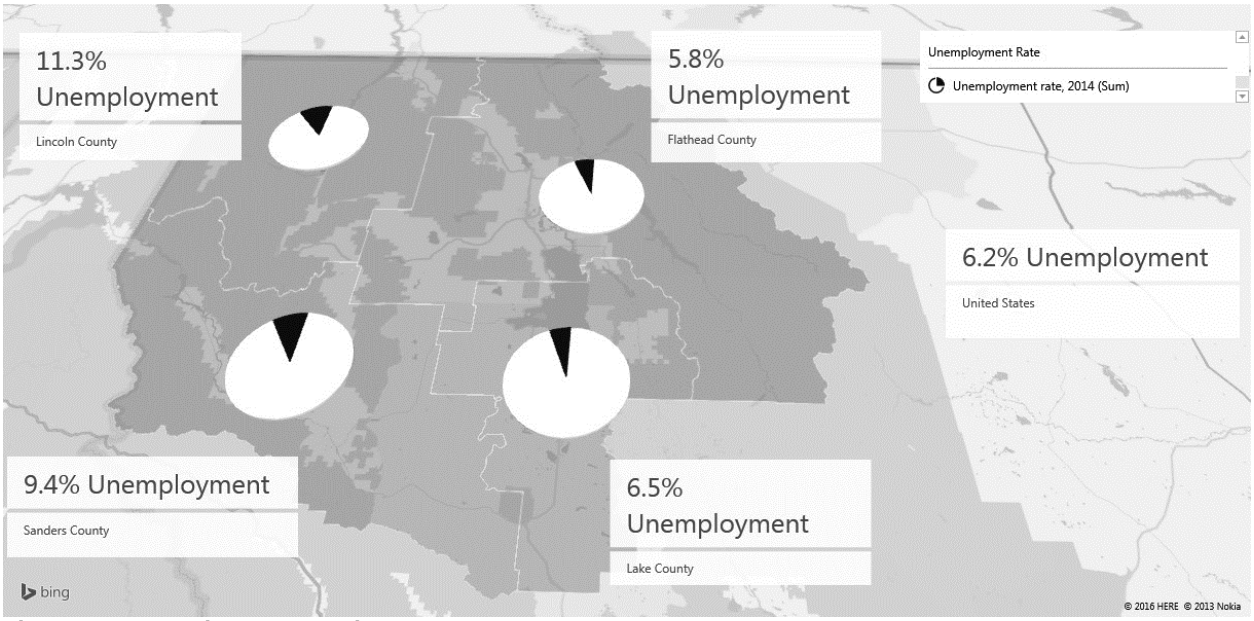


Figure 10. Unemployment rate by county

[9] Lawson, M. 2014. "The Role of Non-Labor Income in the West". Headwaters Economics, published online at http://headwaterseconomics.org.

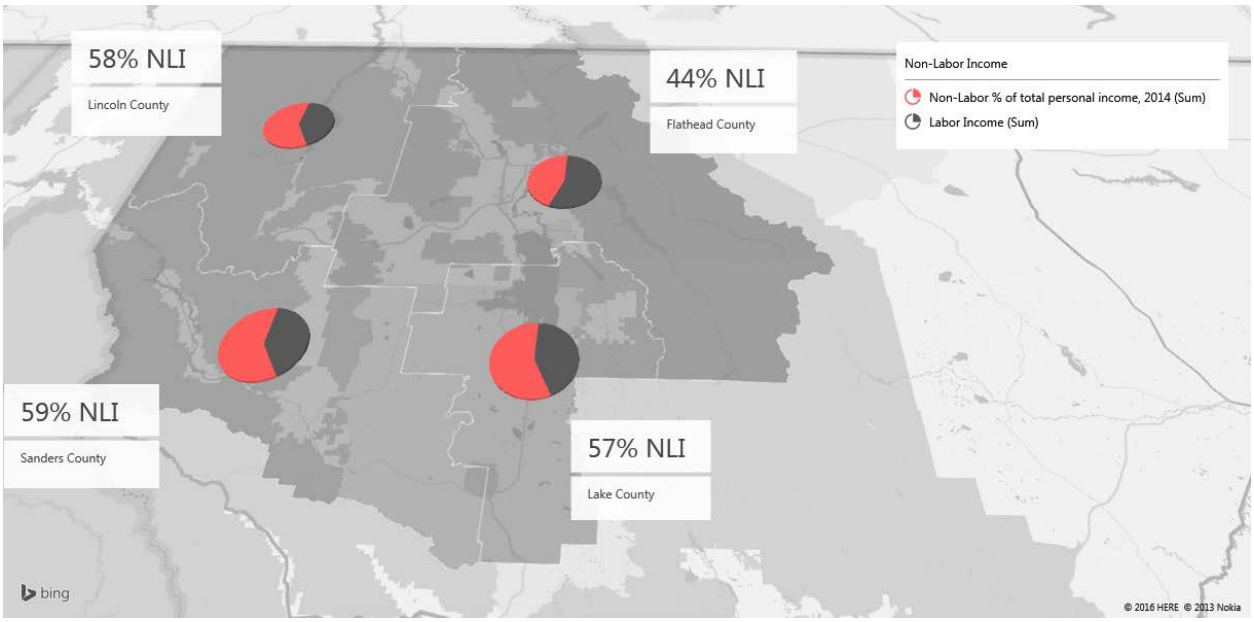


Figure 11. Non-labor income by county

In the table 73, non-labor personal income and other important economic measurements are detailed across the analysis area. Comparing the population, economy and land measurements for the county region, and individual counties to U.S. national averages provides additional information as to the affected economic environment surrounding the Forest.

Table 73. Population, economy and land summary

Economic Measure	Lake County	Flathead County	Lincoln County	Sanders County	County Region	U.S.
Population, 2013, Total	**29,099**	**94,924**	**19,125**	**11,364**	**154,512**	**318,857,056**
Trends						
Population % change, 1970-2013	99.4	139.0	5.9	59.8	94.4	56.5
Employment % change, 1970-2013	184.8	280.7	20.5	82.9	186.4	103.6
Personal Income % change, 1970-2013	280.1	325.0	54.9	160.1	241.6	178.7
Prosperity						
Unemployment rate, 2014, %	5.8	6.5	11.3	9.4	7.1	6.2
Average earnings per job, 2013 (2014 $s)	$31,075	$39,896	$32,121	$27,670	$37,052	$56,965
Per capita income, 2013 (2014 $s)	$31,460	$38,982	$30,996	$29,094	$35,849	$46,049
Economy						
Non-Labor % of total personal income, 2013	57.4	44.4	58.3	59.4	48.9	35.8
Services % of total employment, 2013	54.4	73.0	62.9	57.3	68.2	72.1
Government % of total employment, 2013	22.8	9.0	14.1	13.5	11.9	12.9
Use Sectors						
Timber % of total private employment, 2013	2.3	3.5	5.5	6.5	3.7	0.7

Economic Measure	Lake County	Flathead County	Lincoln County	Sanders County	County Region	U.S.
Mining % of total private employment, 2013	0.1	0.1	4.6	1.0	0.5	0.6
Fossil fuels (oil, gas, & coal), 2013, %	0.0	0.0	0.1	0.0	0.0	0.5
Other mining, 2013, %	0.1	0.1	4.5	1.2	0.5	0.3
Agriculture % of total employment, 2013	8.7	1.8	3.9	9.7	3.5	1.4
Travel & Tourism % of total private employment, 2013	17.8	20.1	19.5	22.4	19.9	15.5
Federal Land*						
Federal Land % total land ownership	16.5	72.9	75.4	54.4	62.8	28.8
Forest Service %	15.1	52.7	74.1	53.8	54.1	8.4
BLM %	0.0	0.0	0.0	0.0	0.0	11.1
Park Service %	0.0	19.1	0.0	0.0	7.6	3.4
Military %	0.0	0.0	1.3	0.0	0.4	1.1
Other %	1.5	1.1	0.0	0.6	0.7	4.7
Federal land % Type A**	17.9	55.4	3.4	5.5	28.2	40.3
Federal payments % of gov. revenue, FY2012	1.9	5.2	24.8	22.8	9.2	
Development						
Residential land area % change, 2000-2010	44.7	37.7	75.5	70.2	47.0	12.3
Wildland-Urban Interface % developed, 2010	12.2	27.2	15.1	6.6	15.5	16.3

Source: Headwaters Economics Economic Profile System (EPS) 2015

In terms of land base, Flathead and Lincoln County boundaries include a higher percentage of public land, where approximately 3 out of every 4 acres are Federal land (figure 12). Among private industries that utilize these lands, travel and tourism industries remain the largest in terms of employment (figure 13). For example, Flathead County maintains a travel and tourism industry that is roughly 10 times the size of its private forestry and forest products sector.

Income and jobs

The Assessment included extensive information on income and jobs for the analysis area. Table 89 in the Assessment (chapter 2, pp. 56–57) displays average earnings per job, per capita personal income, total personal income, and components of personal income for the analysis area. The Assessment indicates that, although per capita personal income is increasing for all four counties, per capita personal income in Montana, at $39,684, was lagging somewhat behind the national average of $42,433 in 2011. For three of the counties in the analysis area, per capita personal income was substantially lower than both the state and the nation. Lake, Lincoln, and Sanders Counties' per capita income ranged from $26,609 in Sanders County to $28,556 in Lake County.

In many places non-labor personal income can be the single largest component of total personal income, and also the largest source of new personal income. For the four counties in the analysis area, only in Flathead County were labor earnings (56.2 percent) a larger component of personal income than non-labor earnings. Sanders County had the largest percentage of personal income attributable to non-labor income at 57.9 percent.

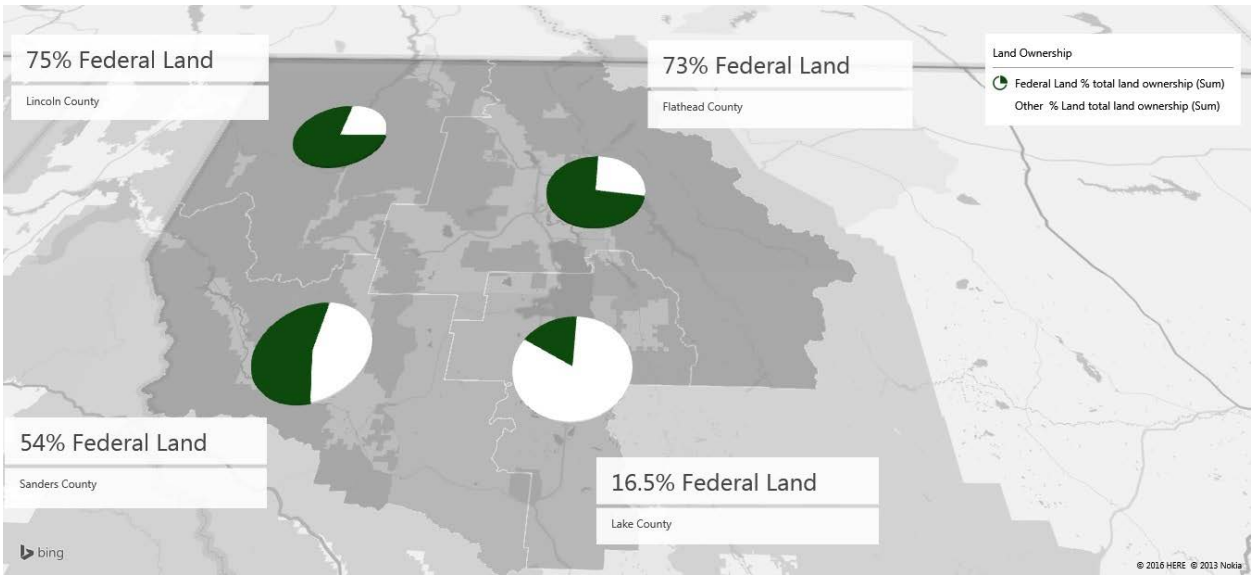


Figure 12. Federal land ownership by county

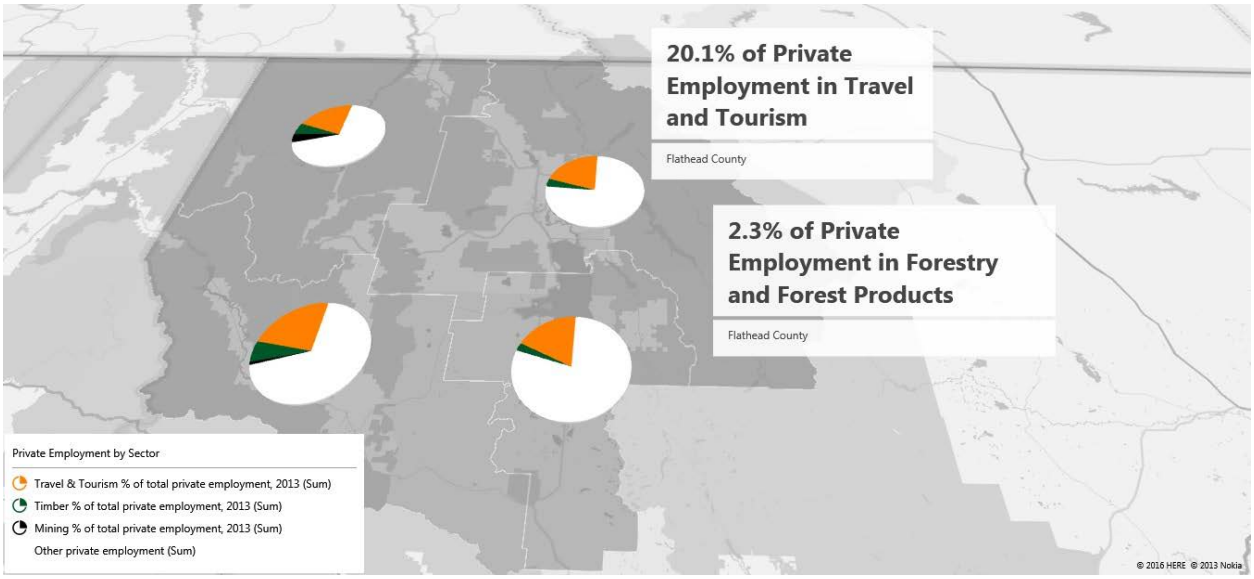


Figure 13. Private employment sectors by county

From 1970 to 2011, there was enormous growth in income maintenance transfer payments, which grew from $8 million to $261 million (2011$). Although other types of transfer payments have also seen large increases over this period, the large rise in income-maintenance payments ("welfare") can have important implications for social and economic sustainability. It also indicates a need for land management agencies to pay particular attention to this segment of society when assessing environmental justice impacts. This is particularly important in Lake County where the percentage of non-labor income derived from income-maintenance payments (at 6.7 percent) is higher than either the state (4.6 percent) or the nation (6.3 percent).

Employment is also an important indicators of the economic health of an area. Employment in the state of Montana increased 12.3 percent from 2001 to 2011, down from the 28 percent increase from 1990 to 2000

reported. Except for Flathead County, where employment increased by 15.54 percent from 2001 to 2011, all other counties in the analysis area saw employment growth that was slower than for the state as a whole.

The Flathead Assessment also contain detailed information on employment by place of work, type, and industry as well as the amount and percentage of employment in each category (service vs. non-service sectors; wage earners vs. proprietors) for the state of Montana and the four-county analysis area (ch2, pp. 58–61, tables 90, 91, 92 and 93).

Services-related employment (include a wide range of jobs from restaurant workers, software developer to doctors) makes up a larger share of the economy than does non-service related jobs in the analysis area. Over the ten years from 2001 to 2011, services-related employment increased for all counties in the analysis area, ranging from a 3.2 percent increase in Lake County up to a 25 percent increase in Flathead County. On the other hand, non-services related employment (such as farming, forestry, mining, construction, and manufacturing) decreased between 7 to 16 percent for the four counties in the analysis area.

From 1990 to 2012, all four counties in the analysis area have had a higher rate of unemployment than the state of Montana. Besides a few instances, Lincoln County has had the highest unemployment rate in the four-county analysis year during the past decade, ranging from a high of 16 percent in 1994 down to 6.4 percent in 2006. See figure 92 in the Flathead Assessment (ch. 2, p. 54) for average annual unemployment rate in the four-county analysis area.

In terms of the industries that relate most directly to the National Forest lands base, agriculture and timber related industries make up a relatively low percentage of the total private employment. Travel and tourism make up a larger portion of private employment in this county region. In figure 14, these specific industries are displayed based on the percent of private employment they contribute to the overall economy in the analysis area. In Sanders County, for example, timber industry employment is much higher in percentage than employment from arts, entertainment and recreation. Conversely, in Flathead these employment sectors are nearly equal. In all counties considered, accommodations and food services employs more individuals than all other sectors considered, combined.

The trends in these National Forest related industries are different. In figure 15, we observe timber related employment, tracked from 1998-2013, diverging from the other forms of employment in the region. This data coincides with other evidence of the region's timber industries decline over recent decades. Conversely, in figure 16, a different trend occurs where travel and tourism related employment grows in step with employment in the rest of the region. Though both sectors are tied to NFS lands, the timber industry is declining in its employment presence relative to other industries. This makes the significance of impacts to the timber industry less in terms of the impact to the overall economy. However, it places greater significance, or sensitivity, on the impacts to the timber industry when considering the industry in isolation, as its own beneficiary.

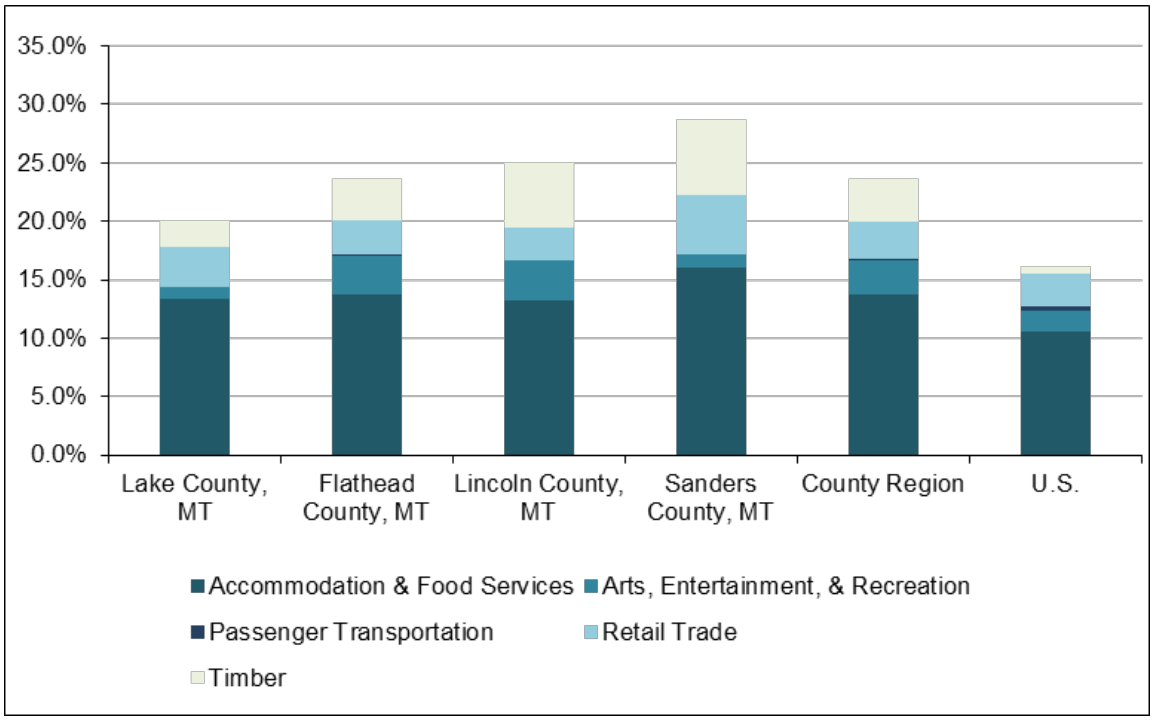


Figure 14. Percent employment represented by industries that support travel & tourism vs. timber, in counties within the analysis area

Source: Headwaters Economics Economic Profile System (EPS) 2015

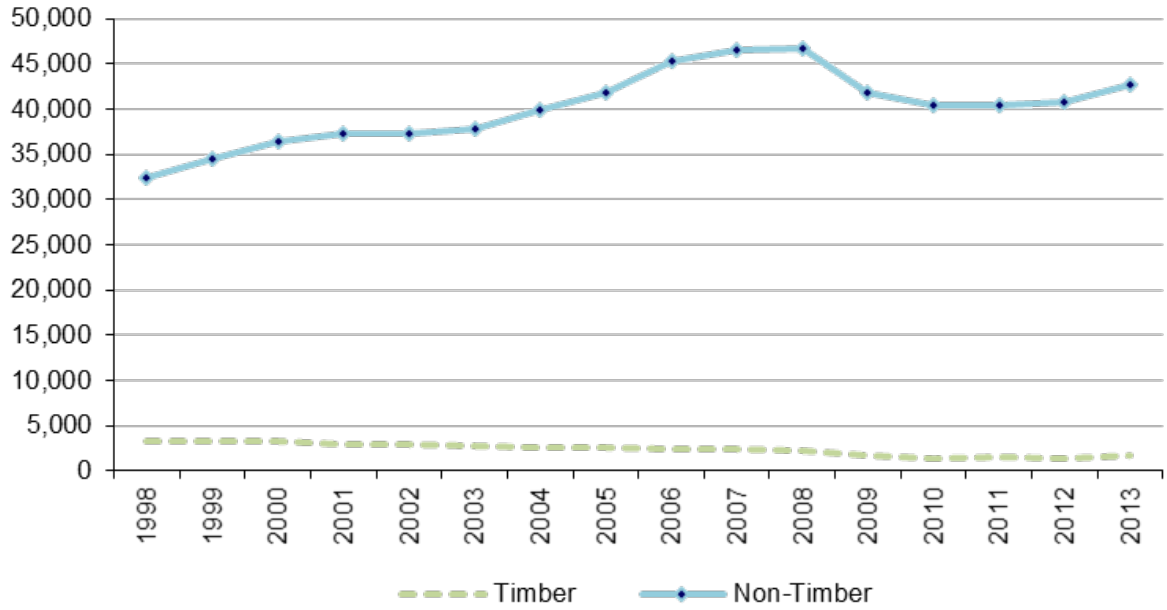


Figure 15. Timber vs. non-timber private employment in counties within the analysis area

Source: Headwaters Economics Economic Profile System (EPS) 2015

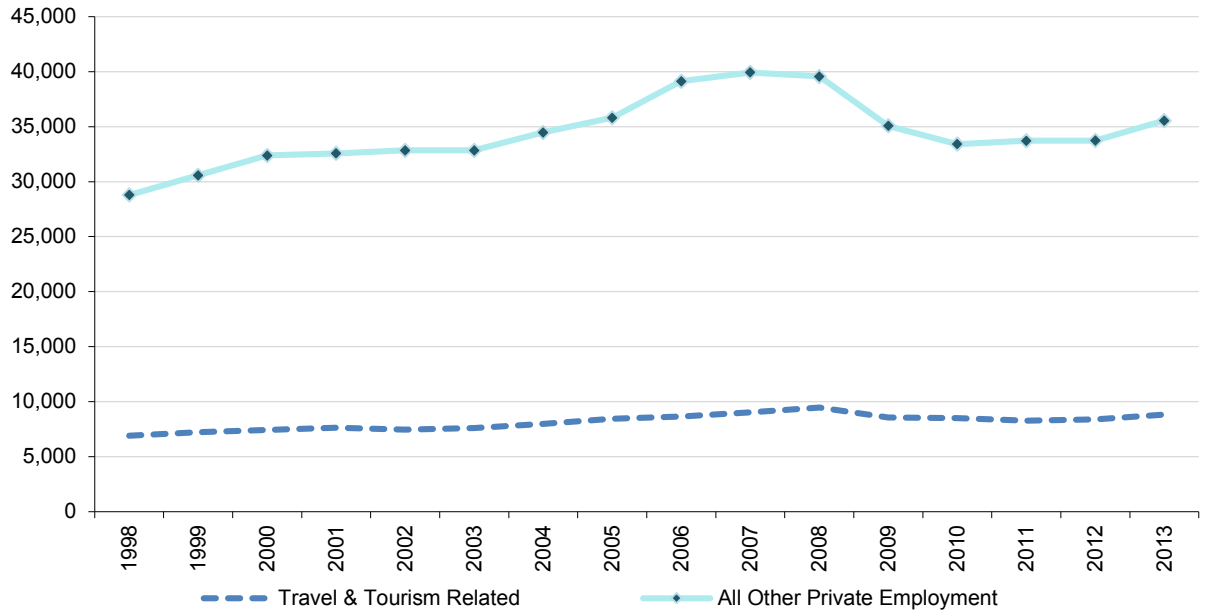


Figure 16. Travel and tourism vs. non-travel private employment in counties within the analysis area
Source: Headwaters Economics Economic Profile System (EPS) 2015

Poverty

In the 2007–2011 period, in Montana, Lake County had the highest estimated percent of individuals living below poverty (23.2 percent), and Flathead County had the lowest (12.7 percent) (table 74). In the 2007–2011 period, Sanders County had the highest estimated percent of families living below poverty (16.3 percent), and Flathead County had the lowest (9.1 percent).

Table 74. Poverty level by age & family type in Montana and by county, 2011*

Family Type	Montana	Flathead	Lake	Lincoln	Sanders	Country Region	U.S.
People	958,682	89,319	28,170	19,323	11,206	148,018	298,787,998
Families	256,806	24,188	7,949	5,987	3,381	41,505	76,507,230
People Below Poverty (% of total)	139,904 (14.6)	11,325 (12.7)	6,533 (3.2)	3,933 (20.4)	2,371 (21.2)	24,162 (16.3)	42,739,924 (14.3)
Families below poverty (percent of total)	25,026 (9.7)	2,212 (9.1)	1,254 (15.8)	893 (14.9)	550 (16.3)	4,909 (11.8)	8,000,077 (10.5)

* The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.
Source: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C. [Accessed via EPS-HDT]

In summary, the affected economic environment in the analysis area is mixed across counties. The counties that remain most sensitive to Forest Service planning are those with a higher percentage of private employment in industries which benefit directly from adjacent National Forest lands. Furthermore, counties with higher poverty rates, higher unemployment, lower income per capita, and higher non-labor

personal income will remain more vulnerable to impacts to employment, i.e. (labor opportunities and income).

Quality of life

Below we discuss the quality of life of local beneficiaries. For ease of analysis, we divide quality of life into three main categories: well-being; health and safety; and traditional, cultural, and spiritual practices.

Well-being

General indicators of the well-being of populations are: educational attainment, income and jobs. As income and jobs were addressed in the previous section, this section focuses on educational attainment.

Educational attainment

The educational attainment is a common indicator of well-being as it is linked to a host of social and economic outcomes including: median earnings, homeownership, health, and children's outcomes. Those with higher levels of educational attainment are also considered less vulnerable to economic and environment shocks (such as the Great Recession and climate change), respectively (Romero Lankao and Qin, 2011). Lack of education is closely linked to poverty. At the county level, studies show that geographies with a higher than average educated workforce grow faster, have higher incomes, and suffer less during economic downturns than other geographies. Those with higher levels of education attainment also tend to be more civically engaged, with higher rates of voting and volunteering, and lower rates of criminal behavior (Dee, 2004).

In the four county study area, educational attainment levels are above the state and national averages in terms of high school graduates (see table 75). The vast majority of residents in the study area, 90.5 percent, have graduated from high school. One-quarter (24.8 percent) have earned a Bachelor's degree or higher. This rate is slightly below the national level and state level of 28.2 percent. There are also significant differences in educational attainment between counties. While Flathead and Lake Counties track closely to state and national averages, Sanders and Lincoln Counties trail behind. Only 16.5 percent and 17.2 percent of residents (25 and older) in Sanders and Lincoln Counties respectively, have earned a Bachelor's degree or above. These disparities in educational attainment suggest that Flathead and Lake County residents may be less socially vulnerable than their counterparts in Lincoln and Sanders Counties.

Table 75. Educational attainment percent of total in US, Montana, and by county in region

Education	Montana (%)	Flathead (%)	Lake (%)	Lincoln (%)	Sanders (%)	County Region (%)	U.S. (%)
No high school degree	8.6	8.0	10.1	13.2	12.9	9.5	14.6
High school graduate	91.4	92.0	89.9	86.8	87.1	90.5	85.4
Associates degree	8.0	8.4	9.3	8.9	5.9	8.4	7.6
Bachelor's degree or higher	28.2	27.6	25.5	17.2	16.5	24.8	28.2
Bachelor's degree	19.4	19.3	16.1	12.1	12.8	17.2	17.7
Graduate or professional	8.8	8.3	9.3	5.0	3.6	7.7	10.5

* The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

Source: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C. [Accessed via EPS-HDT]

Well-being summary

Overall, residents of the four county study area enjoy a relatively high level of well-being. Educational attainment rates are higher than that of the nation as a whole, a key social indicator of overall well-being.

Health and safety

General indicators of the level of health and safety of communities include: access to exercise opportunities, air quality, water quality, income inequality, crime and life expectancy.

The health and safety conditions of the study area are relevant to forest planning as certain land management decisions may improve or worsen county health conditions. Therefore, it is important to consider the current health levels and conditions in the study area. Indicators included in the County Health Rankings and Roadmaps (a database of community health indicators provided by the University of Wisconsin, Population Health Institute, School of Medicine and Public Health) most relevant to land managers include: access to exercise opportunities, water quality and air quality. Income inequality and violent crime rates are also pertinent as resource extraction projects may lead to the creation of "boom towns," which have been shown to increase income inequality, temporarily disrupt communal ties, and increase fear of violent crime in the short term (Smith et al., 2001).

Table 76. Indicators of health and safety levels in the analysis area related to land management

Health and Safety Indicators	Montana	Flathead County	Lake County	Lincoln County	Sanders County
Access to exercise opportunities[1]	72%	79%	51%	95%	74%
Air pollution - particulate matter[2]	10.9	11.4	11.3	11.4	11.2
Drinking water violations[3]	12%	3%	27%	67%	6%
Income inequality[4]	4.4	4.1	4.9	4.4	3.9
Violent crime[5]	272	298	392	224	195

1 Percentage of population with adequate access to locations for physical activity

2 Average daily density of fine particulate matter in micrograms per cubic meter (PM2.5)

3 Percentage of population potentially exposed to water exceeding a violation limit during the past year

4 Ratio of household income at the 80th percentile to income at the 20th percentile

5 Number of reported violent crime offenses per 100,000 population

Source: County Health Rankings and Roadmaps. 2015. University of Wisconsin, Population Health Institute, School of Medicine and Public Health. http://www.countyhealthrankings.org/app/montana/2015/

There are significant disparities in health conditions across counties. While the vast majority of residents in Flathead, Lincoln and Sanders counties enjoy access to exercise opportunities, only 51 percent of residents in Lake County have adequate access.

The air pollution levels in the analysis area are only slightly above the state as a whole and relatively constant across the four counties. The low levels of air pollution local beneficiaries enjoy are likely due, in part, to the high concentration of forested land in the area. The Air Quality section (3.8) contains for more details on air quality on the Flathead National Forest.

The Lake County violent crime rate is significantly higher than the other three counties, and over one-third higher than the state average.

Lake and Lincoln Counties have also experienced higher than average rates of exposure to unsafe drinking water (measured as reported Environmental Protection Agency violations of drinking water systems). Violations could be related to maximum contaminant levels, treatment techniques, and/or

monitoring and reporting requirements to ensure that water systems provide safe water. For more details on water quality on the Flathead National Forest, please see the Water Quality section.

Income inequality, a marker of social cohesion (Wilkinson and Pickett, 2006), also varies across the study area. In Lake County, households in the top 20 percent of the income distribution earn almost five times as much as those in the bottom 20 percent. In Sanders and Flathead Counties, households at the top earn only four times as much.

A common indicator of overall health used by the World Health Organization (WHO) and other international organizations is life expectancy at birth. This measures the number of years a child born today is expected to live, given current mortality trends. It is considered by public health professionals as a helpful snapshot of the overall health levels in a given area. The Institute of Health Metrics and Evaluation at the University of Washington calculates life expectancy for U.S. counties. In 2013, the life expectancy at birth for males in Montana was 76.4 years, slightly below the US average of 76.5. While the levels of life expectancy do not differ substantially across counties, it is worth noting that life expectancy in Flathead County is several years longer than in Lincoln County, for both men and women. In Lake County, while female life expectancy is above the state average, male life expectancy is slightly below.

Table 77. Life expectancy at birth

Life Expectancy	Montana	Flathead County	Lake County	Lincoln County	Sanders County
Life Expectancy at Birth (Males)	76.4	77.1	75.5	75	76.2
Life Expectancy at Birth (Females)	81.2	82.4	82	80.1	80

Source: U.S. Health Map, Institute of Health Metrics and Evaluation. 2013. University of Washington, Seattle, WA. [Accessed via http://vizhub.healthdata.org/us-health-map/]

The health conditions identified using the County Health Ranking indicators above may be contributing to the lower than average life expectancies observed in Lincoln and Lake Counties, and the higher than average levels in Flathead County.

Health and safety summary

The analysis area enjoys a relatively high level of health and safety. Life expectancies for all counties are at or near the state level. Air pollution is only slightly above the state level, highlighting the importance the Forest plays in providing clean air. Water quality varies by county, with both Lincoln and Lake Counties receiving a high level of violations, likely due to the quality of the systems providing safe drinking water, rather than the water quality on the forest. All counties, save Lake County, enjoy a high level of access to exercise, likely due in part to their proximity to outdoor recreation activities on the Forest.

Traditional, cultural and spiritual values

The forest has been supporting cultural traditions for thousands of years and its landscapes serve as a reminder of traditions shared across generations. Contemporary uses of resources and places are critical to maintaining the cultural identity of these communities. Given the ranges of uses, it is not surprising that beneficiaries hold conflicting values and understandings of how the Forest should be managed. While nearly half of Americans believe more public lands should be designated as Wilderness, the remainder

believe the current amount is either sufficient or too high[10]. While some favor motorized recreation opportunities, others prize more primitive experiences. In the following section, we discuss the benefits the Forest provides to local beneficiaries and the general public in terms of opportunities to express traditional, cultural and spiritual values. For more detailed information on traditional, cultural and spiritual values, please see the Cultural and Historic Resources, Recreation and Wilderness sections.

Traditional, cultural, spiritual values summary
Beneficiaries of the Forest enjoy a high level of opportunity to express traditional, cultural and spiritual values. The Forest provides these opportunities by employing a multiple use management strategy which allows for: timber harvest and the gathering of forest products, grazing, outdoor recreation, scenery, fishing, hunting, wildlife viewing, inspiration (spiritual and existence values), solitude, and cultural/heritage values.

Societal benefits

The Forest contributes to economic and social sustainability by providing the following key benefits. These benefits provide income, jobs and/or enrich the quality of life of local communities and the general public. This is not an exhaustive list of all the benefits the forest provides. These are “key” benefits -- those that were identified as highly valued and likely to be affected by the forest plan.

Water quality

The provision of abundant, clean water is a key forest ecosystem service which contributes to human health and safety. While forests, forest soils and watersheds provide a considerable amount of clean water to human populations, human uses and natural events can also diminish a forests ability to provide plentiful, clean water. The primary water pollutant delivered from NF lands is sediment, which in high, sustained concentrations can limit the ability of watersheds to support aquatic life. Sediment can also be a maintenance cost concern for municipal watersheds, and if untreated can lower the quality of drinking water, changing both smell and taste.

Surface water quality is regulated under the authority of the U.S. and Montana Clean Water Act, whereby Montana’s Department of Environmental Quality assesses waters within proper jurisdiction and reports to the EPA stream segments and other water bodies with “impaired” quality, which do not meet water quality standards for beneficial uses. These segments, or bodies of water, must then be assigned and regulated by a total maximum daily limit (TMDL) and monitored for improving conditions.

Within the Forest, the Department of Environmental Quality identified sediment caused impaired conditions on Logan Sheppard, Coal, Goat, and Jim creeks. Additionally, Haskill Creek was ranked as a top municipal water supply priority for the U.S. Forest Service Legacy Program, due to rising concerns for increasing sediment caused by human modifications, including permanent developments.

Ground water is also an important resource in Montana and it will likely become more important in the future as the state’s population and industries grow. More than half of Montanans depend on groundwater for their primary water supply. According to the Natural Resource Information Service, groundwater provides 94 percent of Montana’s rural domestic-water supply and 39 percent of the public-water supply. Water generated in the mountains of the forest is an important source of recharge for valley aquifers and is therefore an important forest product.

[10]Scott, Douglas. 2003. “A Mandate to Protect America’s Wilderness.” Campaign for America’s Wilderness. Washington, DC

Ground water can be contaminated by; leaks from underground fuel storage tanks and pipes, leaks from cemeteries, leaks from waste disposal sites such as landfills, seepage from septic systems and cess pools, accidental spills from truck and train mishaps, saline runoff from roads and highways, seepage from animal feed lots, irrigation return flow, leaching and seepage from mine spoils and tailings, and improper operation of injection wells (Keller, 1992). None of these activities occur on the Forest, although hauling of coal from North Dakota on railcars along the Middle Fork Flathead River remains a concern to water quality, health and safety.

Water quality on and around the Forest remains relatively high, and delivery of water from the Forest to municipal sources including valley aquafers, will remain an important ecosystem service contributing to the social and economic landscape surrounding the Forest.

Clean air

The provision of clean air, and the cleansing of air are both key Forest ecosystem services which contribute to the areas human health and safety. While healthy forest respire oxygen and actively scrub particles and gaseous pollutants out of the air, they can also become a liability to air quality during wildfires. The primary pollutant delivered from NF lands is smoke, which contains three of six regulated pollutants; carbon monoxide, particle matter, and volatile organic compounds. These pollutants can negatively impact human health, and can contribute to unsafe visibility conditions.

Inspiration-spiritual values, existence values and solitude

The opportunity to experience solitude or a spiritual connection to nature is another benefit the Forest provides. These inspirational benefits enhance the quality of life of those who hold these values. Both local community members and the general public enjoy these benefits. People can be inspired by, and connect with nature, in all recreation opportunity spectrum classes (see the Recreation section for a description of recreation opportunity spectrum). For some user groups, such as backpackers and backcountry skiers, primitive and semiprimitive nonmotorized settings provide the most inspirational opportunities associated with solitude. For motorized and mechanized recreation users, roaded natural and rural settings provide the most inspiration or opportunities to connect with nature through various activities such as snowmobiling, skiing and camping in developed campgrounds. For others, simply knowing that wild lands (such as wilderness), wildlife (such as grizzly bear and lynx) and wild and scenic rivers exist in the Forest is a benefit, even if they never plan to visit. Native American tribes in the region hold particularly strong existence values around grizzly bear (Kellert et. al. 1996). The existence of these lands and species, in and of themselves, serves as an inspiration, and enhances their quality of life (Watson et. al. 2015). For others, opportunities to experience solitude, particularly in wilderness areas, is a benefit (McKenna et. al., forthcoming).

For more details on specific areas where visitors may experience inspiration through solitude or spiritual connection to nature on the Forest, please see the Recreation, Wilderness, and Wild and Scenic Rivers sections. For more details on rare species, see the Wildlife sections.

Cultural/heritage values

The plan area is the traditional homeland of the Kootenai and Salish peoples and to a lesser extent, the Blackfeet people. The Flathead National Forest contains many historic and cultural sites which are valued by local communities, tribes and the general public. The forest is generally perceived as an important part of the culture and heritage of area communities and attributed with protecting a number of sites of cultural and historic importance. Many stakeholders believe that forest management of these sites increases public awareness of and access to opportunities to learn and interpret their cultural and historic significance. By preserving and facilitating the interpretation of these resources the forest provides cultural legacy and

heritage values and ensures that these values will be passed on to present and future generations. The existence of these sites, as well as, the ability to access these sites, increases the quality of life of those of who value them.

In addition to specific cultural sites, ecosystem integrity also contributes to the sustainability of tribal belief systems. These belief systems, including traditional ecological knowledge, are inextricably linked to ecosystem health and resilience (CTKW, 2014)[11].

For more details on the cultural and heritage sites, see the Cultural resources section.

Carbon sequestration and climate regulation

Measuring the degree to which NF contribute to carbon sequestration and climate regulation is a complex matter, because forests soil and stand conditions, along with human uses and natural events all affect the sequestration and release of greenhouse gases. The Forest Service recognizes the vital role that carbon sequestration plays in mitigating greenhouse gases emissions. Carbon dioxide uptake by forests in the conterminous United States offsets over 14 percent of our national total carbon dioxide emissions each year (USEPA 2013). Forests and other ecosystems are carbon sinks because, through photosynthesis, growing plants remove carbon dioxide from the atmosphere and store it. For a description on the carbon storage potential on the Flathead National Forest, and its association with greenhouse gases emissions and climate change, see the carbon sequestration section of the DEIS, chapter 3.

Flood control

The Forest vegetation and soils provides for flood control. As the wildland-urban interface continues to expand, more people and property may be at risk of flooding. By minimizing erosion and maintaining healthy riparian areas, the Forest ecosystem mitigates flood risk to communities. Fire is also a main driver of erosion and flood risk. By helping to maintain a healthy ecosystem and reduce fire risk, the Forest provides for flood control.

Forest products, vegetation management and forage

Forest products are key income and job sustaining resources provided by the Forest. Forest products provide a wide range of incomes, across a number of economic sectors from raw materials for wood products manufacturing, to foraged products which are often sold in local markets. As discussed early, forest products are linked to a shrinking forest products sector of the economy, relative to other areas of activity in the four county region. This is seen as both as a limiting factor in the potential scale of economics impacts, and simultaneously an increased sensitivity to this particular beneficiary group.

Outdoor recreation

Outdoor recreation contributes to income, jobs and quality of life. Outdoor recreation on the Forest generates a considerable amount of income and sustains a number of jobs by helping drive demand for goods and services which support recreation travelers and recreation activities. Downhill skiing, for example, generates direct and indirect spending and jobs for recreation, food and hospitality, and arts and entertainment sectors. These activities are most important to track for non-local parties, where goods and

[11] Climate and Traditional Knowledges Workgroup (CTKW). 2014. Guidelines for Considering Traditional Knowledges in Climate Change Initiatives.

service spending would not otherwise occur in an area. For more details on Recreation specifics, please see the Recreation section (3.9).

Scenery

Scenery is a key benefit of the Flathead National Forest that contributes to well-being. Local community members enjoy the scenic values of the Forest lands on a regular basis. Many have the opportunity to view scenic landscapes on the way to work or during their daily routine. The opportunity to enjoy these scenic landscapes is a key benefit to local communities. Scenery is also a benefit provided to visitors who come to the area for business or recreation. Scenery also contributes income to local communities (citation). There are many areas with high scenic integrity throughout the forest. Property values are affected by high-quality scenery, which contributes to higher rental incomes and homes values (need citation). For more detailed information on the scenery resource of the Forest provides, please see the Scenery section.

Fish and wildlife

Fish and wildlife from the Forest contribute to the overall income and jobs benefit providing a unique influence on non-local travel, and ultimately influence key forms of travel and recreation. Hunting, fishing and wildlife viewing generate considerable direct and indirect spending and jobs for recreation, food and accommodation, and arts and entertainment sectors. In Montana, the hunting, fishing, and wildlife viewing economy is estimated to total over $1.2 billion in direct annual expenditures (FHW/11-MT, Dec 13). A good portion of this activity occurs in and around the Flathead National Forest, and occurs as a result of wildlife and fish opportunities provided by the Forest.

Beyond spending and job creation, benefits to people from wildlife and wildlife experiences include more directly the opportunities for recreation, food provision, and a variety of more intangible experiences and connections of individual and community significance. These values are not always accessible to measure in economic trends or data, but are generally viewed to be a crucial quality of life factor for many of the county area residents around the Forest, and to many who travel to this area of Montana seeking wildlife experiences.

Research/education

The Forest provides opportunities for research and education. This is a key benefit that enhances the quality of life for the local communities and as well as the general public. Research conducted on the Forest benefits the larger scientific community. Educational programming benefits those who take part, both local community members and the general public, by enriching their understanding of ecosystems, wildlife and the cultural and heritage sites in the Forest. The educational programming on the Forest provides a nice supplement to public education in the plan area. The Forest also provides educational programming related to wildlife, wildfires and general best practices in outdoor recreation that are invaluable to forest fire prevention as well as in instances of human/wildlife interaction. The Forest also contains six designated research natural areas which provide excellent opportunities for researchers to advance forest science. For more details on the research areas within the Forest, please see the Research Natural Areas section.

Other income/jobs (including Payments to Counties, Secure Rural Schools)

Agency operations, in addition to the other multiple use resources, provides income and jobs to local economies surrounding the Forest.

Another main economic relation between Federal land and county economies are Federal revenue sharing and land payments including Secure Rural Schools (SRS) and payments in lieu of taxes (PILT). “State

and local government cannot tax federally owned lands the way they would if the land were privately owned. A number of federal programs exist to compensate county governments for the presence of federal lands. These programs can represent a significant portion of local government revenue in rural counties with large federal land holdings such as those counties in the analysis area.

Before 1976, all federal payments were linked directly to receipts generated on public lands. Congress funded payments in lieu of taxes with appropriations beginning in 1977 in recognition of the volatility and inadequacy of federal revenue sharing programs. Payments in lieu of taxes was intended to stabilize and increase federal land payments to county governments. More recently, the Secure Rural Schools and Community Self-Determination Act of 2000 decoupled Forest Service payments from commercial receipts. Secure Rural Schools received broad support because it addressed several major concerns around receipt-based programs--volatility, the payment level, and the incentives provided to counties by linking federal land payments directly to extractive uses of public lands.

Payments in lieu of taxes and Secure Rural Schools each received a significant increase in federal appropriations in FY 2008 through the Emergency Economic Stabilization Act of 2008. Despite the increased appropriations, SRS is authorized only through FY 2011, payments in lieu of taxes only through FY 2012, and federal budget concerns are creating uncertainty for the future of both"[12].

Payments in lieu of taxes formulas specifically are based foremost on population and acres of Federal land. Under this payment structure, Flathead County receives a considerably higher payments in lieu of taxes payment, than the other counties in this region, $2.4 million annually. Conversely, Lincoln and Sanders counties rely heavily on Secure Rural Schools payments which make up a large percentage of their total Federal land payment. Four graphics that show the data that support this discussion is provided in figure 17

Fire suppression

The Forest and other Forest Service units provide forest suppression services to local communities. These services contribute to the safety of community homes and infrastructure. Fire suppression activities also provide jobs and income to local communities, as often local businesses are contracted to provide fire suppression equipment and resources.

[12] Federal Land Payments Report, Headwaters Economics, 2014.

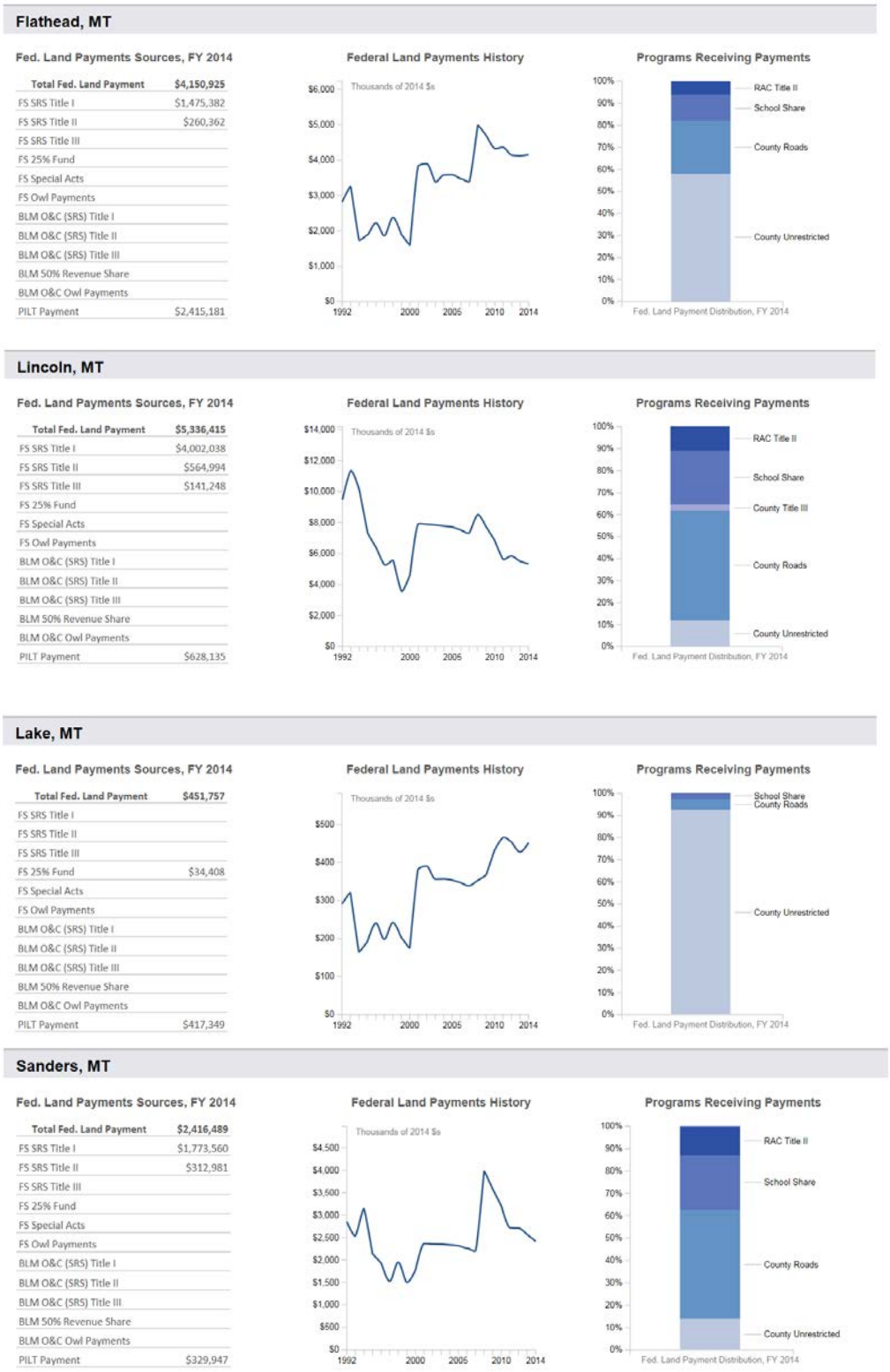


Figure 17. Federal land payments by source and county

Source: Headwaters Economics Economic Profile System (EPS) 2015

3.26.7 Environmental justice

In 1994, President Clinton issued Executive Order 12898. This order directs federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agencies to identify impacts that are disproportionately high and adverse with respect to minority or low-income populations and identify alternatives that will avoid or mitigate those impacts.

In the context of forest planning, it is important to assess whether the forest plan and alternatives will affect how key societal benefits are currently distributed across populations. Specifically, the environmental justice mandate dictates that we examine whether low-income and minority groups will be disproportionately deprived of these benefits or unable to access these benefits with the same ease as the population as a whole.

The census data presented in the previous sections describe the demographics conditions of communities surrounding the Forest. These data indicate that there is a concentration of minority and low-income populations within the planning area. These environmental justice populations are most prevalent in Lake County, where there are high concentrations of Native-American families living below the poverty line.

3.26.8 Environmental consequences

The previous sections assessed the social and economic conditions and demographic trends in order to establish a baseline understanding of how the Forest contributes to social and economic sustainability of local beneficiaries and the general public. The key dimensions assessed are how the Forest currently contributes to income, jobs and the quality of life of local beneficiaries and the general public. The following section will consider the potential consequences of alternative management scenarios on contributions of the Forest to these three key dimensions of social and economic sustainability: income, jobs and quality of life. Quality of life is sub-divided into three sub-categories: well-being, health and safety, and traditional, cultural and spiritual values.

Effects common to all alternative

Population trends

As described in the Affected Environment section, the population of local beneficiaries of the Forest is growing, particularly in Flathead County, due to net in-migration. These new migrants, often referred to as natural amenity migrants, chose to migrate to the area, at least in part, due to the scenic beauty and outdoor recreation supported by the Forest. Communities surrounding the Forest, such as Whitefish, have become increasingly attractive as places to live because of their proximity to open spaces and natural settings which provide residents with easy access to recreational opportunities year round. Under all the alternatives, these open spaces and natural settings would continue to contribute to a higher quality of life for area communities. As populations continue to grow with natural amenity migrants, there will be increased demand for the benefits the forest provides including outdoor recreation, forest products and fish and wildlife. Population growth in the WUI is also a concern. The higher number of homes in these areas increases demand for fire suppression and adds increasing challenges for fire and fuels management efforts. For more details of how population growth impacts fire and fuels management, please see the Fire and Fuels section.

Income and jobs

Under all the alternatives, the Forest will continue to provide benefits to local beneficiaries and the general public which enhance their economic opportunities for employment and earning income. These specific economic contributions are detailed in the tables below, Table 67-69. Income and employment levels influenced by multiple use resources provided by the Forest do not fluctuate widely between alternatives. Tax revenues are also considered in Table 69. State and local tax revenues may fluctuate based on alternative, in similar proportion to changes expected in state and local jobs and income.

Table 78. Labor Income by resource by alternative (average annual, in thousands of 2014 U.S. dollars)

Resource	A	B	C	D
Recreation: non-local only ($)	26,284	26,284	26,284	26,284
Wildlife and Fish: non-local only ($)	1,025	1,025	1,025	1,025
Grazing ($)	64	64	64	64
Timber ($)	15,861	15,241	12,555	15,965
Minerals ($)	1	1	1	1
Ecosystem Restoration ($)	0	0	0	0
Payments to States/Counties ($)	4,937	4,937	4,937	4,937
Forest Service Expenditures ($)	42,496	42,496	42,496	42,496
Total Forest Management ($)	90,668	90,048	87,362	90,772
Percent Change from Current (%)	---	-0.7	-3.6%	0.1

Table 79. Employment by resource by alternative (average annual, in thousands of 2014 U.S. dollars)

Resource	A	B	C	D
Recreation: non-local only	982	982	982	982
Wildlife and Fish: non-local only	34	34	34	34
Grazing	5	5	5	5
Timber	427	411	338	430
Minerals	0	0	0	0
Ecosystem Restoration	0	0	0	0
Payments to States/Counties	109	109	109	109
Forest Service Expenditures	1,094	1,094	1,094	1,094
Total Forest Management	2,652	2,635	2,562	2,655
Percent Change from Current	---	-0.6%	-3.4%	0.1%

Table 80. State and local tax impact by resource by alternative (average annual, in thousands of 2014 U.S. dollars)

Resource	A	B	C	D
Recreation: non-local only	4,293	4,293	4,293	4,293
Wildlife and Fish: non-local only	162	162	162	162
Grazing	0	0	0	0
Timber	2,277	2,187	1,795	2,292
Minerals	0	0	0	0
Ecosystem Restoration	0	0	0	0
Payments to States/Counties	354	354	354	354
Forest Service Expenditures	4,738	4,738	4,738	4,738
Total Forest Management	11,825	11,734	11,343	11,840
Percent Change from Current	---	-0.6%	-3.4%	0.1%

Federal land payments to counties

Under all the alternatives, Payment in Lieu of Taxes and other Federal land payments would continue to reflect Federal land ownership and population growth patterns. Very little changes will likely occur in Federal land ownership; however, population change will remain a driving factor in future Payment in Lieu of Taxes payments. Populations are not expected to fluctuate as a result of alternatives, and therefore Payment in Lieu of Taxes payments are not expected to change across alternatives.

For Secure Rural Schools and other revenue sharing in Title I, II, and III payments, Federal policy changes and executive budgets establish the structure of the payments and how they will continue into the future. Forest planning will not protect or guarantee these payments, but may influence the payment levels which are currently formulated on forest receipts. Alternative C may reduce forest receipts, due to lower overall project levels. This would decrease revenue sharing, proportionally.

Quality of Life

Under all the alternatives, the Forest will continue to provide benefits to local beneficiaries and the general public which enhance their quality of life through contributions to well-being, health and safety and traditional, cultural and spiritual values. The contributions are described in detail in the sections below.

Scenery

Direct and indirect effects: The Scenery section of the DEIS finds that under all alternatives there would be little to no change in the landscape character of a natural appearing and natural evolving forested landscape. Therefore, there is no significant impact to the quality of life of local beneficiaries and the general public in terms of impacts to the scenic character of the Forest. For more detailed information on scenery, please see the Scenery section.

Research/education

Direct and indirect effects: Under all the alternatives, the Forest will continue to provide opportunities for research and education. The Research Natural Areas section of the DEIS finds that all six areas will be maintained and there will be no adverse effects to these research areas. Therefore, there is no significant impact to the quality of life of local beneficiaries and the general public in terms of research and educational opportunities provided by the Forest. For more detailed information refer to the Research Natural Areas section.

Water quality
Direct and indirect effects: Under all alternative, important legal actions such as participation in Watershed Conservation Networks, restoration of impaired watersheds, and BMP's will continue to be executed.

Clean air
Direct and indirect effects: All action alternatives must meet air quality standards established by federal and state agencies through requirements of state implementation plans and smoke management plans. Use of prescribed fire under the action alternatives would be restricting by how much vegetation can be burned and when and where burns can occur. The costs of conducting prescribed fires also increase as a result of burning regulations, which also affects how much vegetation is burned. The limitations for the use of prescribed fire affect the rate and volume of smoke and particulate emissions, which in turn limits impacts to visibility.

Cumulative effects: Most impacts to air quality and visual quality are related to the contribution of smoke from areas to the south and west of the Forest including all the way to the west coast. Historically, when there are not large fires providing additional smoke to the area, prescribed fires and most wildfires have not produced long-term declines in air or visual quality.

Carbon sequestration and climate regulation
Direct and indirect effects: Under all the alternatives, management strategies would increase the likelihood of sustaining and perhaps increasing the Flathead forests' ability to sequester carbon over both the short and long term. All action alternatives include a desired condition addressing the sustainability of carbon storage and sequestration potential through maintenance or enhancement of biodiversity and function, and managing for resilient forests.

Flood control
Direct and indirect effects: Under all the alternatives, the Forest will continue to mitigate flood risk to communities within the forest watersheds by minimizing soil erosion and promoting healthy vegetation conditions across the forest. Level of management activities do vary by alternative, but the extent to which soils are affected under each Alternative will vary by project site so it is not possible to determine differences in the extent to which the Forest may provide for flood control under each alternative. For more detailed information on soil and watershed impacts, please see the Soils section.

Outdoor recreation
Direct and indirect effects: Under all the alternatives, the Forest will continue to offer a portfolio of recreation opportunities to communities and non-local visitors. Recreation opportunities are essential to quality of life for neighboring communities, and to the extent in which alternatives influence non-local visitation for high cost recreation (e.g. downhill skiing, snowmobiling, guided hunting and fishing, etc.) there would be potential impacts to local economies. As detailed in Table 67, and 68, recreation spending is an influencer of local economies, however, it is not anticipated that recreation related spending will significantly change between alternatives. For more specific information on impacts to recreation, please see the Recreation section.

Forest products
Direct and indirect effects: Under all the alternatives, the Forest will continue to provide opportunities for forest product utilization including foraging for forest products such as huckleberry or mushroom picking. Opportunities for non-commercial forest product utilization will not vary greatly by alternative. Commercial timber harvest opportunities do vary by alternative, with the most harvest under alternative D and the least under alternative C. Traditional values associated with forest products would not be

impacted greatly by any of the plan alternatives, although commercial timber harvest is decreased under alternative C.

Grazing
Direct and indirect effects: Under all the alternatives, the Forest will continue to provide opportunities for livestock grazing including transitory forage. Opportunities for both existing and new grazing allotments, will not vary greatly by alternative. Traditional values associated with range management would not be impacted greatly by any of the plan alternatives.

Fish and wildlife
Direct and indirect effects: Under all the alternatives, the Forest will continue to manage critical habitat and monitor ecosystem health for species of concern. To the extent in which alternatives influence wildlife and wildlife habitat there may be linkages to recreation opportunities, and recreation spending in the economy. The most critical spending for local economies comes from non-local visitation. Though alternatives are not currently anticipated as having a range of impacts to wildlife recreation, it is important to note that were an alternative to promote or deter non-local wildlife recreation it could lead to an impact in local economies. For more detailed information on specific wildlife impacts, please see the Wildlife section.

Cultural/heritage values
Direct and indirect effects: Under all alternatives, the Forest will provide protection and access to areas of cultural and historic importance. The level of management activities does vary by alternatives, thus the opportunity to express cultural/heritage values may also vary by alternatives. For more details on the effects to cultural and heritage resources, please see the Cultural Resources section.

Cumulative effects: As a result of the implementation of the GBCS on amended forests, “bear management units within the primary conservation area and zone 1 would have temporary access restrictions during denning season. During denning season it may be more difficult for Native Americans to access sites within these bear management units across all the forests.” (Cultural Resources section).

Inspirational values
Direct and indirect effects: Under all the alternatives, the Forest will continue to provide opportunities for inspiration through outdoor recreation and protection of wildlife, wild and scenic rivers and wilderness areas. Opportunities for solitude are provided in all alternatives. Solitude and inspiration can occur in all recreation opportunity spectrum classes. The primitive and semi-primitive non-motorized settings are often more associated with solitude, compared to the roaded natural setting and rural settings. The recreation opportunity spectrum class allocation on the forest varies by alternatives (see Recreation section). Designated wilderness areas are the same for all alternatives however recommended wilderness areas and allowed uses differ by alternatives. Thus, opportunities for solitude and inspiration for different user groups may also vary by alternative. Protections for grizzly bear habitat, and thus existence values, are provided for across alternatives, but to varying degrees. For more details on areas and opportunities of inspiration (through solitude or spiritual connection to nature) on the Forest, please see the Recreation section, the Wilderness section and the Wild and Scenic Rivers section.

No-action alternative A

Income and Jobs

Under alternative A, the Forest would continue to provide economic opportunities, and sustain jobs and income to a similar degree with all other alternatives. Most noticeably, however, alternative A, relative to alternative C, would allow for greater annual forest management activity and sustain harvest volumes that

would equate with approximately $3 million more in income and 100 more jobs across all four counties. Relative to the entire county area economy, this is a relatively small impact, but to the timber industry specifically, this is a noticeable change in economic activity.

Quality of Life

Under alternative A, the No action alternative, the Forest will continue to provide benefits to local beneficiaries and the general public which enhance their quality of life through contributions to well-being, health and safety and traditional, cultural and spiritual values. Contributions that differ from other alternatives are described in detail in the sections below.

Water quality

The most significant change between action alternatives and the existing plan (alternative A), is the incorporation of additional forestwide standards that are specifically designed to protect aquatic resources. Alternative A would not implement these additional forestwide standards, and would have water quality risks associated with forest management activities. Between alternatives, alternative A has the highest general management risk towards maintaining water quality.

Clean air

Under the no-action alternative, natural and human impacts to clean air, including wildfire and prescribed fire, are not expect to differ greatly across alternatives.

Forest products

Under all the alternatives, the Forest will continue to provide opportunities for forest product utilization including foraging for forest products such as huckleberry or mushroom picking type outdoor recreation. Under alternative A, commercial timber harvest levels are higher than alternatives C and B, but less than alternative D. Traditional values associated with forest products and forest product industries would not be impacted greatly by this alternative.

Grazing

Under the no-action alternative, grazing management, as outlined in the affected environment of the Livestock Grazing section, would continue. Additionally, allotment plans and associated protections for forest resources would also continue. Forage management would continue to provide the necessary AUMs designated on grazing permits. The quantity and size of grazing allotments could change from the current condition. Additional grazing allotments could be added if they were to meet the goals and guidelines of the existing MAs.

Under the no-action alternative (alternative A), more acres of timber would be suitable for timber harvest than action alternatives. This means suitability and utilization for livestock grazing under the no-action alternative (alternative A) could result in the creation of more transitory range than the action alternatives. The no-action alternative (alternative A) would provide the most potential for transitory range creation. Alternative A may require the addition of range improvements to limit access to different areas outside the designated allotments.

Fish and wildlife:

Under the no-action alternative wildlife habitat management for most species would have less than the preferred level of management direction, this is true for general biodiversity characteristics such as riparian areas, as well as for key species habitat such as the grizzly bear and hunted megafauna. Grizzly habitat management under the no-action alternative would lack the benefit of a coordinated NCDE grizzly bear habitat management strategy.

Benefits to people from wildlife and wildlife experiences range broadly, but generally relate positively with levels of biodiversity and sustainability. Evidence of this is observed in many places including where biodiversity is demanded in global tourism and travel industries. Beyond the present time, additional benefits from wildlife occur from repeated and generationally shared experiences. Efforts to improve the sustainability and resiliency of habitat conditions will help extend wildlife benefits through individual lives as well as across generations.

To the extent that the no-action alternative limits habitat preservation and forgoes management direction to maintain healthy, sustainable ecosystems, there will remain higher risks of biodiversity loss and reduced wildlife experiences and other related benefits. For more information on wildlife, see the environmental consequences on wildlife sections..

Inspiration-spiritual values, existence values and solitude

Alternative A provides about 49 percent (1,170,486 acres) of the forest that is in designated or recommended wilderness. These acres provide a primitive and semi-primitive non-motorized setting that often are associated with solitude, although many areas not within designated or recommended wilderness also provide for solitude. Visitors connect with nature though many different activities and thus are inspired not only in wilderness or primitive areas, but also by activities such as snowmobiling, mountain biking and camping in developed campgrounds. Inspiration values are provided across the entire forest for different desired experience by the visitors. This alternative provides more solitude and inspirational values associated with motorized and mechanized recreation opportunities than alternative C, but less than alternatives B and D. It provides less solitude and inspirational values associated with wilderness and recommended wilderness than alternatives B and C but more than D.

Under alternative A, bear conservation polices are not coordinated across the forests. As such, the health of bear habitat will be more difficult to manage and monitor (see Wildlife section). The NCDE grizzly bear conservation strategy advocates for a coordinated approach to motorized access and secure core, developed recreation sites, livestock grazing, vegetation management, and minerals and energy development. Under the alternative A, adjacent national forests will continue to provide their own direction on these key management issues. The NCDE strategy assumes that a coordinated effort is necessary to adequately maintain grizzly bear habitat. Therefore, under the no action alternative, there is a greater likelihood of a decline in grizzly bear habitat conditions. This could result in a negative impact on forests' abilities to provide for existence values. If the grizzly bear population declines, this impacts people's ability to be inspired by the existence of grizzly bears and to provide this inspiration for generation to come.

Cultural/heritage values

Access to cultural/heritage sites may be more limited under Alternative A given the direction of amendment 19, which requires the closing of roads. This limitation on roads may impede access to areas of cultural and historic significance. For more details on the effects to cultural and heritage resources under alternative A, please see the Cultural Resources section.

Alternatives B, C, and D

Income and jobs

Under Alternative B, the Forest would continue to provide economic opportunities, and sustain jobs and income to a similar degree with all other alternatives. Most noticeably, however, Alternative B, relative to Alternative C, would allow for greater annual forest management activity and sustain harvest volumes that would equate with approximately $3 million more in income and 100 more jobs across all four

counties. Relative to the entire county area economy, this is a relatively small impact, but to the timber industry specifically, this is a noticeable change in economic activity.

Under Alternative C, the Forest would continue to provide economic opportunities, and sustain jobs and income to a similar degree with all other alternatives. Most noticeably, however, Alternative C would allow for less annual forest management activity and sustain harvest volumes that would equate with approximately $3.4 million less in income and 100 fewer jobs across all four counties, than would be sustained in the other Alternatives. Relative to the entire county area economy, this is a relatively small impact, but to the timber industry specifically, this is a noticeable change in economic activity.

Under Alternative D, the Forest would continue to provide economic opportunities, and sustain jobs and income to a similar degree with all other alternatives. Most noticeably, however, Alternative D, relative to Alternative C, would allow for greater annual forest management activity and sustain harvest volumes that would equate with approximately $3 million more in income and 100 more jobs across all four counties. Relative to the entire county area economy, this is a relatively small impact, but to the timber industry specifically, this is a noticeable change in economic activity.

Quality of life

Under alternative B, the Forest will continue to provide benefits to local beneficiaries and the general public which enhance their quality of life through contributions to well-being, health and safety and traditional, cultural and spiritual values. Contributions that differ from other alternatives are described in detail in the sections below.

Under alternative C, the Forest will continue to provide benefits to local beneficiaries and the general public which enhance their quality of life through contributions to well-being, health and safety and traditional, cultural and spiritual values. Contributions that differ from other alternatives are described in detail in the sections below.

Under alternative D, the Forest will continue to provide benefits to local beneficiaries and the general public which enhance their quality of life through contributions to well-being, health and safety and traditional, cultural and spiritual values. Contributions that differ from other alternatives are described in detail in the sections below.

Water quality

The most significant change between action alternatives and alternative A, is the incorporation of additional forestwide standards that are specifically designed to protect aquatic resources. Alternative C would implement these additional forestwide standards, and would have water quality risks associated with forest management activities. However, between alternatives, alternative B has slightly higher risk of water quality impacts from forest management activities, and retains some benefit from watershed restoration activities.

The most significant change between action alternatives and alternative A is the incorporation of additional forestwide standards that are specifically designed to protect aquatic resources. Alternative C would implement these additional forestwide standards, and would have water quality risks associated with forest management activities. However, between alternatives, alternative C has the least risk of water quality impacts from forest management activities, and retains the greatest benefit from watershed restoration activities.

The most significant change between action alternatives and alternative A, is the incorporation of additional forestwide standards that are specifically designed to protect aquatic resources. Alternative C

would implement these additional forestwide standards, and would have water quality risks associated with forest management activities. However, between alternatives, alternative D has greater risk of water quality impacts from forest management activities, and retains the least benefit from watershed restoration activities.

Clean air

Under all alternatives natural and human impacts to clean air, including wildfire and prescribed fire, are not expect to differ greatly across alternatives.

Forest products

Under all the alternatives, the Forest will continue to provide opportunities for forest product utilization including foraging for forest products such as huckleberry or mushroom picking. Under alternative B, commercial timber harvest levels are higher than alternative C, but less than alternatives A and D. Traditional values associated with forest products and forest product industries would not be impacted greatly by this alternative.

Grazing

Under alternative B and D, the acres available for timber harvest are the same, and therefore the potential for the creation of transitory range is the same. Under the no-action alternative and alternatives B and D, the acres available for summer recreation opportunities are the same, and the potential for livestock conflicts are the same. Recreation effects on livestock grazing of the no-action alternative (alternative A) and alternative B and D would be similar.

Under alternative C, less acres of timber would be suitable for harvest than other alternatives. Alternative C has the lowest acres suitable for timber harvest and would have the lowest potential for the creation of transitory range limiting potential suitability and utilization. Under alternative C, more acres of summer recreation opportunities would be available resulting in more opportunities for livestock conflicts than the other alternatives. Alternative C would also have the most adverse effects on livestock grazing as it relates to the creation of transitory range and potential livestock conflicts.

Under alternative B and D, the acres available for timber harvest are the same, and therefore the potential for the creation of transitory range is the same. Under the no-action alternative and alternatives B and D, the acres available for summer recreation opportunities are the same, and the potential for livestock conflicts are the same. Recreation effects on livestock grazing of the no-action alternative (alternative A) and alternative B and D would be similar.

Fish and wildlife

Under the action alternatives wildlife habitat management for most species would have more preferred levels of management direction, this is true for general biodiversity characteristics such as riparian areas, as well as for key species habitat such as the grizzly bear, hunted megafauna, and fish.

Benefits to people from wildlife and wildlife experiences range broadly, but generally relate positively with levels of biodiversity and sustainability. Evidence of this is observed in many places including where biodiversity is demanded in global tourism and travel industries. Beyond the present time, additional benefits from wildlife occur from repeated and generationally shared experiences. Efforts to improve the sustainability and resiliency of habitat conditions will help extend wildlife benefits through individual lives as well as across generations.

To the extent that the action alternatives lead to a more preferred level of management direction and habitat preservation, wildlife related benefits will be maintained with fewer risks of biodiversity loss, or reduced wildlife experiences.

Inspiration-spiritual values and solitude

Alternative B provides about 53 percent (1,259,740 acres) of the forest that is in designated or recommended wilderness. These acres provide a primitive and semi-primitive non-motorized setting that often are associated with solitude, although many areas not within designated or recommended wilderness also provide for solitude. Visitors connect with nature though many different activities and thus are inspired not only in wilderness or primitive areas, but also by activities such as snowmobiling, mountain biking and camping in developed campgrounds. Inspiration values are provided across the entire forest for different desired experience by the visitors. This alternative provides more solitude and inspirational values associated with motorized and mechanized recreation opportunities than alternative C, but less than alternatives A and D. It provides less solitude and inspirational values associated with wilderness and recommended wilderness than alternative C but more than A and D.

Alternative C provides about 66 percent (1,578,900 acres) of the forest that is in designated or recommended wilderness. These acres provide a primitive and semi-primitive non-motorized setting that often are associated with solitude, although many areas not within designated or recommended wilderness also provide for solitude. Visitors connect with nature though many different activities and thus are inspired not only in wilderness or primitive areas, but also by activities such as snowmobiling, mountain biking and camping in developed campgrounds. Inspiration values are provided across the entire forest for different desired experience by the visitors. This alternative provides the least amount of solitude and inspirational values associated with motorized and mechanized recreation opportunities of all alternatives. It provides the most amount of solitude and inspirational values associated with wilderness and recommended wilderness than all of the other alternatives.

Under Alternative C, a coordinated approach to grizzly bear management, in accordance with the NCDE conservation strategy, will be implemented. Additionally, greater restrictions are placed on access to bear habitat. These measures may result in healthier grizzly bear habitats and populations, compared to alternative B. As a result, this alternative provides for the greatest existence values, as compared to all other alternatives.

Alternative D provides about 45 percent (1,072,040 [13] acres) of the forest that is in designated wilderness. These acres provide a primitive setting that often are associated with solitude, although many areas not within designated wilderness also provide for solitude. Visitors connect with nature though many different activities and thus are inspired not only in wilderness or primitive areas, but also by activities such as snowmobiling, mountain biking and camping in developed campgrounds. Inspiration values are provided across the entire forest for different desired experience by the visitors. This alternative provides the highest amount of solitude and inspirational values associated with motorized and mechanized recreation opportunities of all alternatives. It provides the least amount of solitude and inspirational values associated with wilderness and recommended wilderness than all of the other alternatives.

Cultural/heritage values

Direct effects: Access to cultural/heritage sites may be higher under alternative B, compared to alternative A. However, during the non-denning season, to decrease the potential for grizzly bear-human conflicts, alternative B does limit access to areas within the primary conservation area (PCA), which may also limit

[13] These acres are from GIS acres and differ from official wilderness acres of 1,075,559 acres

access to cultural/heritage sites located within these zones. Under alternative B, restricted roads within the secure core of the PCA will be temporarily open for public motorized use. This allows for more opportunities for the public to participate in traditional and cultural activities such as collecting firewood and visiting cultural sites, compared to alternative C.

For more details on the effects to cultural and heritage resources under alternative B and D, please see the Cultural Resources section. Under alternative C, greater restrictions are placed on access to bear habitat. This allows the public fewer opportunities to participate in traditional and cultural activities such as collecting firewood and visiting cultural sites, compared to alternative B.

Environmental justice

As discussed in the *Affected Environment*, environmental justice populations exist within the 4-county planning area. Populations most at risk of experiencing disproportionately high and adverse human health or environmental effects include low-income households and Native Americans living on reservation lands. These populations are not mutually exclusive and are present throughout the planning area, as shown in the demographic section above.

Under all the alternatives, the Forest and management activities will contribute to social and economic sustainability by providing key benefits to environmental justice communities, by increasing quality of life and providing opportunities for income and jobs. The Forest will continue to provide for traditional, cultural and spiritual values which are of particular interest to Native American tribes. There are no populations in the plan area that will experience significant, adverse human health impacts or environmental effects due to management actions proposed under any of the alternatives.

Cumulative Effects

There are many factors that influence and affect the local social and economic environment. National, state, and county policies affect population growth, demographics, and land uses. Following is a brief description of some items that are changing or may change in the future, adding to the effects on local communities from the alternatives.

Population growth and climate change

The West has been the fastest growing region in the country, and this trend is expected to continue for the next 20 years (U.S. Census 2010 data and projections). With this increased growth rate comes an increased diversification of the population. More new residents are migrating in, while the adult children of families living in the region are moving out of the area to find employment. This change in population composition has added to the diversity of attitudes, lifestyles, and values of the population within the four county area. The social assessment found a concern among some stakeholders that new residents are changing the nature of their communities. As natural amenity migration increases, the demand for outdoor recreation and the cultural value of wildlife viewing may increase. The new wave of natural amenity migrants, who are moving to urban areas, may be more likely to hold existence values around wildlife and recreation over more traditional resource uses (Montag, Patterson and Sutton 2003).

For example, Glacier National Park continues to experience an increase in visitation. This suggests that opportunities for inspiration and solitude in Glacier National Park may be affected. This increase in Glacier National Park visitation may shift visitors to areas of the Flathead National Forest in search of solitude and inspiration. This may shift may result in an increased demand for solitude and inspiration in the primitive and semi-primitive areas of the Forest.

Climate change is predicted to increase the number of hot days in the region, leading to increased summer recreation and cultural visits to the forests (Northern Rockies Adaptation Partnership, ch. 10, Effects of

Climate Change on Recreation). As such, there may be added demand for recreation facilities in summer months.

Development of forestlands and subdivision of private timberlands

There has also been increased housing density adjacent to and within national forest boundaries, and this trend is expected to continue over the next several decades. Moderate and high increases in residential development are projected around national forests located in Montana (Stein et al. 2007). While local urban, county, and regional planners and the public are making progress in defining desirable development and recognizing the inherent costs and effects associated with subdivision sprawl, growth will continue in some form and overall density will increase. This development would likely add pressure on adjacent Forest Service lands. Pressure would include increased demand for potentially conflicting recreation opportunities, services such as road maintenance, demand for undeveloped and semi-primitive settings, and increased fire management problems.

Montana, like many states across the West, is experiencing a massive divestiture of commercial timberlands for development and subdivisions (Montana DNRC 2010). Corporate timberland has become more valuable for recreational or residential real estate than for timber production. This development results in increased fragmentation of forested landscapes with increasing ex-urban migration and greater desire for recreational properties and other amenity values. Impacts of fragmentation include wildlife habitat degradation, public access issues, and increased challenges of providing public services and fire protection for new housing developments. Divestiture of corporate timberlands adds to the current trends for increased housing density within and adjacent to the national forest.

Resource development

Diversification of wood product manufacturing has historically allowed Montana mills to be more resilient in changing markets (Montana DNRC 2010). The majority of timber harvested in Montana comes off state and private lands, with one-third from non-industrial private lands. The Montana Statewide Forest Resource Strategy (Montana DNRC 2010) recognizes the need to foster responsible management of private lands that integrates harvest of traditional and non-traditional forest products as a tool for good land stewardship. The amount of timber harvest on state and private lands and adjacent national forests will affect the local economy. Additional harvest from these lands would help to stabilize local jobs and income. Any decrease in harvest would add to a decrease in associated jobs and income.

Literature Cited

Abele, S. L., Wirsing, A. J., & Murray, D. L. (2013). Precommercial forest thinning alters abundance but not survival of snowshoe hares. Journal of Wildlife Management, 77(1), 84-92. doi:10.1002/Jwmg.426

Adams, L. (1959). An analysis of a population of snowshoe hares in northwestern Montana. Ecological Monographs, 29(2), 141-170.

Ager, A. A., Finney, M. A., & Vaillant, N. M. (2010). A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure. Forest ecology and management, 259(8), 1556-1570.

Ager, A. A., Finney, M. A., & Vaillant, N. M. (2010). A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure. Forest ecology and management, 259(8), 1556-1570.

Ager, A. A., Valliant, N. M., & Finney, M. A. (2010). A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure. Forest Ecology and Management, 259(8), 1556-1570. doi:10.1016/j.foreco.2010.01.032

Al-Chokhachy, R., Muhlfeld, C. C., Boyer, M. C., Jones, L. A., Steed, A., & Kershner, J. L. (2014). Quantifying the Effectiveness of Conservation Measures to Control the Spread of Anthropogenic Hybridization in Stream Salmonids: a Climate Adaptation Case Study. North American Journal of Fisheries Management, 34(3), 642-652. doi:10.1080/02755947.2014.901259

Al-Chokhachy, R., Roper, B. B., & Archer, E. K. (2010). Evaluating the status and trends of physical stream habitat in headwater streams within the interior Columbia River and upper Missouri River basins using an index approach. Transactions of the American Fisheries Society, 139(4), 1041-1059. doi:10.1577/T08-221.1

Alig, R. J. (2011). Effects of climate change on natural resources and communities: a compendium of briefing papers. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/37513 and http://www.fs.fed.us/pnw/pubs/pnw_gtr837.pdf

Allan, J. D., Erickson, D. L., & Fay, J. (1997). The influence of catchment land use on stream integrity across multiple spatial scales. Freshwater Biology, 37(1), 149-161. doi:10.1046/j.1365-2427.1997.d01-546.x

Allen, C. D. (2007). Interactions across spatial scales among forest dieback, fire, and erosion in northern New Mexico landscapes. Ecosystems, 10(5), 797-808. doi:10.1007/s10021-007-9057-4

Allendorf, F. W., Leary, R. F., Spruell, P., & Wenburg, J. K. (2001). The problems with hybrids: setting conservation guidelines. Trends Ecol Evol, 16(11), 613-622. doi:10.1016/S0169-5347(01)02290-X

Altman, B., & Sallabanks, R. (2012). Olive-sided Flycatcher (Contopus cooperi), The Birds of North America Online (A. Poole, Ed.). Retrieved from http://bna.birds.cornell.edu/bna/species/502

Ament, R., Callahan, R., McClure, M., Reuling, M., & Tabor, G. (2014). Wildlife Connectivity: Fundamentals for Conservation Action. Retrieved from Bozeman, MT:

http://largelandscapes.org/library/ and http://largelandscapes.org/media/publications/Wildlife-Connectivity-Fundamentals-for-Conservation-Action.pdf

Anderson, A., & Turnock, B. (2012). Black Swift (Cypseloides niger) Surveys in Northwest Montana 2012. Retrieved from Kalispell, MT: No URL was located.

Anderson, C. J., & Lockaby, B. G. (2011). Research Gaps Related to Forest Management and Stream Sediment in the United States. Environmental Management, 47(2), 303-313. doi:10.1007/s00267-010-9604-1

Anderson, K. H., & Thompson, R. S. Historic Variations in Moisture Availability. Retrieved from http://geochange.er.usgs.gov/sw/changes/natural/pdsi/

Anderson, N., Young, J., Stockmann, K., Skog, K. E., Healey, S., Loeffler, D., . . . Morrison, J. (2013). Regional and forest-level estimates of carbon stored in harvested wood products from the United States Forest Service Northern Region, 1906-2010. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/45091 and http://www.fs.fed.us/rm/pubs/rmrs_gtr311.pdf

Anderson, S., Johnson, W., Roberts, D., Summerfield, B., Swisher, K., Conard, B., . . . Vandehey, A. (2009). Guide to effects analysis of helicopter use in grizzly bear habitat. Montana/Northern Idaho Level I Terrestrial Biologists Team. Retrieved from http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5336905.pdf

Araújo, M. B., Whittaker, R. J., Ladle, R. J., & Erhard, M. (2005). Reducing uncertainty in projections of extinction risk from climate change. Global Ecology and Biogeography, 14(6), 529-538. doi:10.1111/j.1466-822X.2005.00182.x

Arno, S. F., & Hoff, R. (1990). Whitebark pine (Pinus albicaulis Engelm.). In R. M. Burns & B. H. Honkala (Eds.), Silvics of North America, Vol. 1, Conifers. Agriculture Handbook 654 (pp. 268-279). Washington D. C.: U.S. Department of Agriculture, Forest Service.

Arno, S. F., Harrington, M. G., Fiedler, C. E., & Carlson, C. E. (1995). Restoring Fire-Dependent Ponderosa Pine Forests in Western Montana. Restoration & Management Notes, 13(1), 32-36.

Arno, S. F., Simmerman, D. G., & Keane, R. E. (1985). Forest succession on four habitat types in western Montana. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/29613 and http://www.fs.fed.us/rm/pubs_int/int_gtr177.pdf

Aubry, C., Goheen, D., Shoal, R., Ohlson, T., Lorenz, T., Bower, A., . . . Sniezko, R. (2008). Whitebark pine restoration strategy for the Pacific Northwest Region 2009-2013 Executive Summary. Retrieved from Portland, OR: http://usfsdc.vtls.com:4080/vital/access/manager/Repository/usfs:265?sort=sort_ss_title%2F&f0=sm_mimeType%3A%22application%2Fpdf%22 and http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5279029.pdf

Aubry, K. B., & Raley, C. M. (2002). The Pileated Woodpecker as a Keystone Habitat Modifier in the Pacific Northwest. In W. F. Laudenslayer, Jr., P. J. Shea, B. E. Valentine, C. P. Weatherspoon, & T. E. Lisle (Eds.), Proceedings of the symposium on the ecology and management of dead wood in western forests. 1999 November 2-4; Reno, NV. General Technical Report PSW-181 (pp. 257-274). Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Station.

Aubry, K. B., Koehler, G. M., & Squires, J. R. (1999). Chapter 13: Ecology of Canada Lynx in Southern Boreal Forests. In L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, & J. R. Squires (Eds.), Ecology and Conservation of Lynx in the United States, General Technical Report RMRS-GTR-30WWW (pp. 373-396): U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Aune, K., & Kasworm, W. (1989). Final Report: East Front grizzly studies. Retrieved from Helena, MT:

Balda, R. P., & Kamil, A. C. (1992). Long-Term Spatial Memory in Clark Nutcracker, Nucifraga-Columbiana. Animal Behaviour, 44(4), 761-769. doi:10.1016/S0003-3472(05)80302-1

Barber, J., Bush, R., & Berglund, D. (2011). The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products. Retrieved from Missoula, MT: http://www.fs.usda.gov/detailfull/r1/landmanagement/gis/?cid=stelprdb5331054&width=full; http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5332073.pdf

Barber, J., D. Berglund, R. Bush. 2009. Region 1 Existing Vegetation Classification System and its Relationship to Inventory Data and the Region 1 Existing Vegetation Map Products. USDA Forest Service, Northern Region, CMIA Numbered Report 09-03 5.0. http://fsweb.r1.fs.fed.us/forest/inv/classify/r1_ex_veg_cmi_4_09.pdf

Barber, J., D. Berglund, R. Bush. 2009. Region 1 Existing Vegetation Classification System and its Relationship to Inventory Data and the Region 1 Existing Vegetation Map Products. USDA Forest Service, Northern Region, CMIA Numbered Report 09-03 5.0.

Barber, Jim, Renate Bush, and Doug Berglund. 2011. Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products. USDA Forest Service, Northern Region, Vegetation Classification, Mapping, Inventory, and Analysis Report 11-10. June 2011.

Barber, Jim, Renate Bush, and Doug Berglund. 2011. Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products. USDA Forest Service, Northern Region, Vegetation Classification, Mapping, Inventory, and Analysis Report 11-10. June 2011.

Barnes, K. P., & Belthoff, J. R. (2008). Probability of detection of Flammulated Owls using nocturnal broadcast surveys. Journal of Field Ornithology, 79(3), 321-328. doi:10.1111/j.1557-9263.2008.00166.x

Barrett, S. W. (1988). Fire regime classification for coniferous forests of the northwestern United States. Retrieved from Missoula, MT:

Barringer, L. E., Tomback, D. F., Wunder, M. B., & McKinney, S. T. (2012). Whitebark Pine Stand Condition, Tree Abundance, and Cone Production as Predictors of Visitation by Clark's Nutcracker. Plos One, 7(5), 11. doi:10.1371/journal.pone.0037663

Bartholow, J. M. (2005). Recent water temperature trends in the lower Klamath River, California. North American Journal of Fisheries Management, 25(1), 152-162. doi:10.1577/M04-007.1

Barton, A. M. 2002. Intense wildfire in southeastern Arizona: transformation of a Madrean oak-pine forest to oak woodland. Forest Ecology and Management 165: 205-212.

Barton, A. M. 2002. Intense wildfire in southeastern Arizona: transformation of a Madrean oak-pine forest to oak woodland. Forest Ecology and Management 165: 205-212.

Barton, A. M. (2002). Intense wildfire in southeastern Arizona: transformation of a Madrean oak-pine forest to oak woodland. Forest Ecology and Management, 165(1-3), 205-212. doi:10.1016/S0378-1127(01)00618-1

Basko, B. (2002). Guidelines for analyzing environmental effects on soil. Retrieved from Kalispell, MT: Citation only, no URL

Basko, B. (2007). Guidelines for analyzing environmental effects on soil. Retrieved from Kalispell, MT: Citation only, no URL

Bate, L. J. (2013). Harlequin duck surveys along upper McDonald Creek, Glacier National Park, May-September 2013. Retrieved from Montana:

Bate, L. J. (2014). Harlequin Duck Surveys along Upper McDonald Creek, Glacier National Park. Retrieved from Montana:

Baxter, C. V., Frissell, C. A., & Hauer, F. R. (1999). Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: Implications for a management and conservation. Transactions of the American Fisheries Society, 128(5), 854-867. doi:10.1577/1548-8659(1999)128<0854:Glratd>2.0.Co;2

BCCDC. (2016). B.C. Species and Ecosystems Explorer. Search Results for Pinus albicaulis, whitebark pine. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Jan 26, 2016). Retrieved from Victoria, B.C.: http://a100.gov.bc.ca/pub/eswp/ and http://a100.gov.bc.ca/pub/eswp/reports.do?elcode=PGPIN04010

Beechie, T., & Bolton, S. (1999). An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries, 24(4), 6-15. doi:10.1577/1548-8446(1999)024<0006:Aatrsh>2.0.Co;2

Belsky, A. J., & Gelbard, J. L. (2000). Livestock Grazing and Weed Invasions in the Arid West. Retrieved from Portland, OR: http://www.publiclandsranching.org/htmlres/PDF/BelskyGelbard_2000_Grazing_Weed_Invasions.pdf

Benda, L., & Dunne, T. (1997). Stochastic forcing of sediment supply to channel networks from landsliding and debris flow. Water Resources Research, 33(12), 2849-2863. doi:10.1029/97WR02388

Benda, L., Poff, N. L., Miller, D., Dunne, T., Reeves, G., Pess, G., & Pollock, M. M. (2004). The network dynamics hypothesis: How channel networks structure riverine habitats. Bioscience, 54(5), 413-427. doi:10.1641/0006-3568(2004)054[0413:Tndhhc]2.0.Co;2

Bentz, B.J., Regniere, J., Fettig, C.J., Hansen, E.M., Hayes, J.L., Hicke, J.A., … & Seybold, S.J. (2010, September). Climate change and bark beetles of the Western United States and Canada: Direct and indirect effects. BioScience, 60(8), 602-613. Retrieved from: http://www.usu.edu/beetle/documents/Bentzetal_2010.pdf. (27 September 2011).

Bentz, B.J., Regniere, J., Fettig, C.J., Hansen, E.M., Hayes, J.L., Hicke, J.A., … & Seybold, S.J. (2010, September). Climate change and bark beetles of the Western United States and Canada: Direct and indirect effects. BioScience, 60(8), 602-613. Retrieved from: http://www.usu.edu/beetle/documents/Bentzetal_2010.pdf. (27 September 2011).

Berglund, Doug, R. Bush, J. Barber, and M. Manning. 2009. R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System. USDA Forest Service, Northern Region, Vegetation Classification, Mapping and Inventory Report, 09-01 v2.0. http://fsweb.r1.fs.fed.us/forest/inv/classify/cmia_r1.pdf

Berglund, Doug, R. Bush, J. Barber, and M. Manning. 2009. R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System. USDA Forest Service, Northern Region, Vegetation Classification, Mapping and Inventory Report, 09-01 v2.0. http://fsweb.r1.fs.fed.us/forest/inv/classify/cmia_r1.pdf

Berryman, E. M., Barnard, H. R., Adams, H. R., Burns, M. A., Gallo, E., & Brooks, P. D. (2015). Complex terrain alters temperature and moisture limitations of forest soil respiration across a semiarid to subalpine gradient. Journal of Geophysical Research-Biogeosciences, 120(4), 707-723. doi:10.1002/2014jg002802

Beschta, R. L., Pyles, M. R., Skaugset, A. E., & Surfeet, C. G. (2000). Peakfow responses to forest practices in the western cascades of Oregon, USA. Journal of Hydrology, 233(1-4), 102-120. doi:http://dx.doi.org/10.1016/S0022-1694(00)00231-6

Binkley, D. (1991). Connecting soils with forest productivity. p 66-69. In A. E. Harvey & L. F. Neuenschwander (Eds.), Proceedings: Management and productivity of western-montane forest soils; 1990 April 10-12; Boise, ID (pp. 254). Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Binkley, D., & Brown, T. C. (1993). Forest Practices as Nonpoint Sources of Pollution in North America. Water Resources Bulletin, 29(5), 729-740. doi:10.1111/j.1752-1688.1993.tb03233.x

Birdsey, R. A., Jenkins, J. C., Johnston, M., Huber-Sannwald, E., Amero, B., de Jong, B., . . . Pregitzer, K. S. (2011). Chapter 11: North American Forests. In A. W. King, L. Dilling, G. P. Zimmerman, D. M. Fairman, R. A. Houghton, G. Marland, A. Z. Rose, & T. J. Wilbanks (Eds.), The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (pp. 117-126). Asheville, NC: National Oceanic and Atmospheric Administration, National Climatic Data Center.

Bjornn, T. C., & Reiser, D. W. (1991). Chapter 4 - Habitat Requirements of Salmonids in Streams. In: Influences of forest and rangeland management on salmonid fishes and their habitats, pages 83-138. In W. R. Meehan (Ed.), American Fisheries Society special publication (pp. 751). Bethesda, MD: American Fisheries Society.

Boisvenue, C. and S.W. Running. 2010. Simulations show decreasing carbon stocks and potential for carbon emissions in Rocky Mountain forests over the next century. Ecological Applications 20(5): 13-2-1319.

Boisvenue, C. and S.W. Running. 2010. Simulations show decreasing carbon stocks and potential for carbon emissions in Rocky Mountain forests over the next century. Ecological Applications 20(5): 13-2-1319.

Boisvenue, C., & Running, S. W. (2010). Simulations show decreasing carbon stocks and potential for carbon emissions in Rocky Mountain forests over the next century. Ecological Applications, 20(5), 1302-1319. doi:10.1890/09-0504.1

Bollenbacher, B. (2010). Pattern of vegetation matters on the KIPZ. Retrieved from No URL found

Bollenbacher, B., Bush, R., & Lundberg, R. (2009). Estimates of snag densities for western Montana forests in the Northern Region. Retrieved from Missoula, MT: http://fsweb.r1.fs.fed.us/forest/inv/project/snags.shtml

Bollenbacher, B., Bush, R., & Lundberg, R. (2009). Estimates of snag densities for western Montana forests in the Northern Region. Retrieved from Missoula, MT: http://fsweb.r1.fs.fed.us/forest/inv/project/snags.shtml

Bollenbacher, B., Bush, R., & Lundberg, R. (2009). Estimates of snag densities for western Montana forests in the Northern Region. Retrieved from Missoula, MT: http://fsweb.r1.fs.fed.us/forest/inv/project/snags.shtml

Bond, J. C., Iverson, S. A., Maccallum, N. B., Smith, C. M., Bruner, H. J., & Esler, D. (2009). Variation in Breeding Season Survival of Female Harlequin Ducks. Journal of Wildlife Management, 73(6), 965-972. doi:10.2193/2008-236

Boyd-Heger, D. K. (1997). Dispersal, genetic relationships, and landscape use by colonizing wolves in the central Rocky Mountains. (PhD), University of Montana, Missoula, MT.

Boyer, M. C., Muhlfeld, C. C., & Allendorf, F. W. (2008). Rainbow trout (Oncorhynchus mykiss) invasion and the spread of hybridization with native westslope cutthroat trout (Oncorhynchus clarkii lewisi). Canadian Journal of Fisheries and Aquatic Sciences, 65(4), 658-669. doi:10.1139/F08-001

BPA. (2005). South Fork Flathead Watershed, Westslope Cutthroat Trout Conservation Program, Final Environmental Impact Statement. Retrieved from Portland, OR: http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/EIS-0353-FEIS-2005.pdf

Bradley, A. F., Fischer, W. C., & Noste, N. V. (1992). Fire Ecology of the Forest Habitat Types of Eastern Idaho and Western Wyoming. Retrieved from Ogden, UT: https://archive.org/details/CAT92991181

Bradley, A. F., Noste, N. V., & Fischer, W. C. (1992). Fire ecology of forests and woodlands in Utah. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/25259 http://www.fs.fed.us/rm/pubs_int/int_gtr287.pdf

Bradley, L., Gude, J., Lance, N., Laudon, K., Messer, A., Nelson, A., . . . Steuber, J. (2014). Montana Gray Wolf Conservation and Management. 2013 Annual Report. Retrieved from Helena, MT: http://fwp.mt.gov/wolf; http://fwp.mt.gov/fishAndWildlife/management/wolf/

Bradley, L., Gude, J., Lance, N., Laudon, K., Messner, A., Nelson, A., . . . John, S. (2013). Montana Gray Wolf Conservation and Management 2012 Annual Report. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/management/wolf/

Bradley, L., Gude, J., Lance, N., Laudon, K., Messner, A., Nelson, A., . . . Vore, J. (2015). Montana Gray Wolf Conservation and Management 2014 Annual Report. Retrieved from Helena, Montana: http://fwp.mt.gov/fishAndWildlife/management/wolf/

Breashears, D.D., and C.D. Allen. 2002. The importance of rapid, disturbance-induced losses in carbon management and sequestration. Global Ecology and Biogeography 11:1-5.

Breashears, D.D., and C.D. Allen. 2002. The importance of rapid, disturbance-induced losses in carbon management and sequestration. Global Ecology and Biogeography 11:1-5.

Brodie, J., Johnson, H., Mitchell, M., Zager, P., Proffitt, K., Hebblewhite, M., . . . White, P. J. (2013). Relative influence of human harvest, carnivores, and weather on adult female elk survival across western North America. Journal of Applied Ecology, 50(2), 295-305. doi:10.1111/1365-2664.12044

Brookshire, D. S., Eubanks, L. S., & Randall, A. (1983). Estimating Option Prices and Existence Values for Wildlife Resources. Land Economics, 59(1), 1-15. doi:10.2307/3145871

Brown, J. (2006). Moose management in northwest Montana. Retrieved from No URL found

Brown, J. K., Reinhardt, E. D., & Kramer, K. A. (2003). Coarse woody debris: Managing benefits and fire hazard in the recovering forest. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/5585; http://www.fs.fed.us/rm/pubs/rmrs_gtr105.pdf

Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A. 2003. Coarse woody debris: managing benefits and fire hazard in the recovering forest. Gen. Tech. Rep. RMRS-GTR-105. Ogden, UT: USDA, Forest Service, Rocky Mtn. Res. Sta. 16 p.

Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A. 2003. Coarse woody debris: managing benefits and fire hazard in the recovering forest. Gen. Tech. Rep. RMRS-GTR-105. Ogden, UT: USDA, Forest Service, Rocky Mtn. Res. Sta. 16 p.

Bull, E. L. (1987). Ecology of the Pileated Woodpecker in Northeastern Oregon. Journal of Wildlife Management, 51(2), 472-481. doi:10.2307/3801036

Bull, E. L. (2006). Sexual Differences in the Ecology and Habitat Selection of Western Toads (Bufo Boreas) in Northeastern Oregon. Herpetological Conservation and Biology, 1(1), 27-38.

Bull, E. L., & Holthausen, R. S. (1993). Habitat Use and Management of Pileated Woodpeckers in Northeastern Oregon. Journal of Wildlife Management, 57(2), 335-345. doi:10.2307/3809431

Bull, E. L., Heater, T. W., Clark, A. A., Shepherd, J. F., & Blumton, A. K. (2005). Influence of precommercial thinning on snowshoe hares. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/8382; http://www.fs.fed.us/pnw/pubs/pnw_rp562.pdf

Bull, E. L., Nielsen-Pincus, N., Wales, B. C., & Hayes, J. L. (2007). The influence of disturbance events on pileated woodpeckers in Northeastern Oregon. Forest Ecology and Management, 243(2-3), 320-329. doi:10.1016/j.foreco.2007.03.031

Burden, R. F., & Randerson, P. F. (1972). Quantitative Studies of the Effects of Human Trampling on Vegetation as an Aid to the Management of Semi-Natural Areas. Journal of Applied Ecology, 9(2), 439-457. doi:10.2307/2402445

Bush, R., & Lundberg, R. (2008). Wildlife Habitat Estimate Updates for the Region One Conservation Assessment. Retrieved from Missoula, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5130739.pdf

Bush, R., & Reyes, B. (2014). Overview of FIA and Intensified Grid Data. Region One Vegetation Classification, Mapping, Inventory and Analysis Report. Report 14-13 v2.0. Retrieved from http://fsweb.r1.fs.fed.us/forest/inv/fia_data/index.shtml

Bush, R., Berglund, D., Leach, A., Lundberg, R., & Zeiler, J. (2006). Overview of R1-FIA Summary Database, Region 1 Vegetation Classification, Mapping, Inventory and Analysis Report http://fsweb.r1.fs.fed.us/forest/inv/fia_data/r1_sum_db.htm. Retrieved from Missoula, MT: http://fsweb.r1.fs.fed.us/forest/inv/fia_data/r1_sum_db.htm

Bush, Renate, D. Berglund, A. Leach, R. Lundberg, and J.D. Zeiler. 2006. Overview of R1-FIA Summary Database, Region 1 Vegetation Classification, Inventory, and Analysis Report #06-02. 2006. http://fsweb.r1.fs.fed.us/forest/inv/fia_data/r1_sum_db.htm.

Bush, Renate, D. Berglund, A. Leach, R. Lundberg, and J.D. Zeiler. 2006. Overview of R1-FIA Summary Database, Region 1 Vegetation Classification, Inventory, and Analysis Report #06-02. 2006. http://fsweb.r1.fs.fed.us/forest/inv/fia_data/r1_sum_db.htm.

Buskirk, S. W., & Powell, R. A. (1994). Habitat ecology of fishers and American martens. In S. W. Buskirk, A. S. Harestad, M. G. Raphael, & R. A. Powell (Eds.), Pages 283-396. In: Martens, Sables, and Fishers: Biology and Conservation (pp. 484). Ithaca, New York: Cornell University Press.

Buskirk, S. W., & Ruggiero, L. F. (1994). Chapter 2 - American Marten. In: The Scientific Basis for Conserving Forest Carnivores. American Marten, Fisher, Lynx, and Wolverine in the Western United States. Retrieved from Fort Collins, CO: http://www.fs.fed.us/rm/pubs_rm/rm_gtr254.pdf

Buskirk, S. W., Forrest, S. C., Raphael, M. G., & Harlow, H. J. (1989). Winter Resting Site Ecology of Marten in the Central Rocky Mountains. Journal of Wildlife Management, 53(1), 191-196. doi:10.2307/3801330

Butler, C. J., Garrott, R. A., & Rotella, J. J. (2013). Correlates of Recruitment in Montana Bighorn Sheep Populations. Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwim79fv26nKAhUNxmMKHel5DY4QFggcMAA&url=http%3A%2F%2Ffwp.mt.gov%2FfwpDoc.html%3Fid%3D70561&usg=AFQjCNF2e7yDdVbWNPdNWdMNG7o6ex9NPw

Butler, R. W. (1992 (revised 2011)). Great blue heron (Ardea herodias). In: A. Poole and F. Gill, eds. The Birds of North America, Number 25. Washington, D. C.: The Academy of Natural Sciences, Philadelphia and the American Ornithologists Union.

Byler, James W., and Susan K. Hagle. 2000. Succession Functions of Forest pathogens and Insects. Ecosections M332a and M333d in Northern Idaho and Western Montana; Summary. USDA Forest Service, Northern Region, FHP Report No. 00-09. July 2000.

Byler, James W., and Susan K. Hagle. 2000. Succession Functions of Forest pathogens and Insects. Ecosections M332a and M333d in Northern Idaho and Western Montana; Summary. USDA Forest Service, Northern Region, FHP Report No. 00-09. July 2000.

Byrd, A., Kneeland, M., Persico, C., & Evers, D. (2015). Montana Common Loon (Gavia Immer) Summary Report, 2014. Retrieved from Portland, ME: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiowbLkqIzLAhUC7mMKHcI3ArMQFggcMAA&url=http%3A%2F%2Ffwp.mt.gov%2FfwpDoc.html%3Fid%3D69419&usg=AFQjCNF-486qaQDOoqjou1azLF-mLu1cNw&bvm=bv.114733917,d.cGc

Caissie, D. (2006). The thermal regime of rivers: a review. Freshwater Biology, 51(8), 1389-1406. doi:10.1111/j.1365-2427.2006.01597.x

Cambi, M., Certini, G., Neri, F., & Marchi, E. (2015). The impact of heavy traffic on forest soils: A review. Forest Ecology and Management, 338, 124-138. doi:10.1016/j.foreco.2014.11.022

Canadell, J. G., Pataki, D. E., Gifford, R., Houghton, R. A., Luo, Y., Raupach, M. R., . . . Steffen, W. (2007). Part A: Carbon and water cycles in the 21st century; Chapter 6: Saturation of the terrestrial carbon sink. In J. G. Canadell, D. E. Pataki, & L. F. Pitelka (Eds.), Terrestrial ecosystems in a changing world (pp. 59-78): Global Change – The IGBP Series, Springer Berlin Heidelberg New York.

Canepa, S., Annis, K., & Kasworm, W. (2008). Public opinion and knowledge survey of grizzly bears in the Cabinet Yaak Ecosystem. Retrieved from Montana: http://www.igbconline.org/html/sc-reports.html

Canfield, J. E., Lyon, L. J., Hillis, J. M., & Thompson, M. J. (1999). Ungulates. In G. Joslin & H. Youmans (Eds.), Pages 6.1-6.25. In: Effects of recreation on Rocky Mountain wildlife: A Review for Montana (pp. 307): Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Casey, D. (2000). Partners in Flight Bird Conservation Plan Montana. Retrieved from Kalispell, MT: No URL was found.

Casey, D. (2004). Coordinated bird monitoring in Montana. Special species monitoring: Black Swift. Prepared for the Montana Bird Conservation Partnership and the University of Montana. Retrieved from Kalispell, MT:

Casey, D., Altman, B., Stringer, D., & Thomas, C. (2013). Cavity-nesting bird habitat and populations in ponderosa pine forests of the Pacific Northwest. Retrieved from http://iwjv.org/resource/pnw-ponderosa-pine-and-birds

Cassirer, E. F., & Groves, C. R. (1994). Ecology of Harlequin Ducks in Northern Idaho. Retrieved from Boise, ID:

CCSP. (2007). The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Retrieved from Asheville, NC: http://www.fws.gov/southeast/climate/policy/Climate%20USCCSP%20State%20of%20Carbon%20Cycle%20sap2-2-final-all.pdf

CEQ. (2014). Draft guidance to Federal agencies on when and how to consider the effects of greenhouse gas emissions and climate change. Washington D.C.: Council on Environmental Quality (CEQ) Retrieved from

https://www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf.

Chadde, S. W., Kimball, S. F., & Evenden, A. G. (1996). Research Natural Areas of the Northern Region: Status & needs assessment. Natural Areas Program. Retrieved from Missoula, MT: http://www.treesearch.fs.fed.us/pubs/41673; http://www.fs.fed.us/rm/pubs_other/rmrs_1996_chadde_s001.pdf

Chadde, S. W., Shelly, J. S., Bursik, R. J., Moseley, R. K., Evenden, A. G., Mantas, M., . . . Heidel, B. (1998). Peatlands on National Forests of the Northern Rocky Mountains: ecology and conservation. Retrieved from Ogden, UT: http://www.fs.fed.us/rm/pubs/rmrs_gtr011.pdf

Cheng, E., Mills, L. S., & Hodges, K. E. (2011). Evaluating the prey base for lynx: Snowshoe hare distribution and abundance in Glacier National Park. Retrieved from Missoula, MT: http://www.cfc.umt.edu/CESU/Reports/NPS/UMT/2005/05_07_GLAC_Mills_snowshoe%20hare_finalrpt.pdf

Choate, T. S. (1963). Ecology and population dynamics of White-tailed ptarmigan (Lagopus leucurus) in Glacier National Park, Montana. (PhD), University of Montana, Missoula, MT. Retrieved from No URL found

Choate, T. S. (1963). Habitat and population dynamics of White-tailed ptarmigan in Montana. The Journal of Wildlife Management, 27(4), 684-699. doi:10.2307/3798485

Choromanska, U., & DeLuca, T. H. (2002). Microbial activity and nitrogen mineralization in forest mineral soils following heating: evaluation of post-fire effects. Soil Biology & Biochemistry, 34(2), 263-271. doi:10.1016/S0038-0717(01)00180-8

Cilimburg, A. (2006). 2005 Flammulated Owl Surveys Final Report, Northern Region Landbird Monitoring Program. Retrieved from Missoula, MT:

Cilimburg, A. (2006). Northern Region Landbird Monitoring Program 2005 Flammulated Owl Surveys. Retrieved from Missoula, MT: No URL found.

Claar, J. J., Anderson, N., Boyd, D., Cherry, M., Conard, B., Hompesch, R., . . . Youmans, H. (1999). Carnivores. In G. Joslin & H. Youmans (Eds.), Pages 7.1– 7.63. In: Effects of recreation on Rocky Mountain wildlife: A Review for Montana (pp. 307): Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Clarkson, P. (1992). A preliminary investigation into the status and distribution of Harlequin Ducks in Jasper National Park. Retrieved from

Clayton, J. L. (1990). Soil Disturbance Resulting From Skidding Logs on Granitic Soils in Central Idaho. Retrieved from Ogden, UT: https://archive.org/details/soildisturbancer436clay

Clough, L. T. (2000). Nesting Habit at Selection and Productivity of Northern Goshawks in West-Central Montana. (Master of Science), University of Montana, Missoula, MT.

Clough, L. T. (2001). Nesting habitat selection and productivity of Northern Goshawks in west-central Montana. Intermountain Journal of Sciences, 7, 129.

Coates, K. D., & Haeussler, S. (1986). A Preliminary Guide to the Response of Major Species of Competing Vegetation to Silvicultural Treatments. Victoria, B.C., Canada: British Columbia Ministry of Forests and Lands, Information Services.

Coleman, M. A., & Fausch, K. D. (2007). Cold summer temperature limits recruitment of age-0 cutthroat trout in high-elevation Colorado streams. Transactions of the American Fisheries Society, 136(5), 1231-1244. doi:10.1577/T05-244.1

Collins, B. M., Miller, J. D., Thode, A. E., Kelly, M., van Wagtendonk, J. W., & Stephens, S. L. (2008). Interactions among wildland fires in a long-established Sierra Nevada natural fire area. Ecosystems, 12(1), 114-128.

Collins, B. M., Miller, J. D., Thode, A. E., Kelly, M., van Wagtendonk, J. W., & Stephens, S. L. (2008). Interactions among wildland fires in a long-established Sierra Nevada natural fire area. Ecosystems, 12(1), 114-128.

Collins, B. M., Miller, J. D., Thode, A. E., Kelly, M., Wagtendonk, J. W., & Stephens, S. L. (2008). Interactions Among Wildland Fires in a Long-Established Sierra Nevada Natural Fire Area. Ecosystems, 12(1), 114-128. doi:10.1007/s10021-008-9211-7

Conant, R. T., Paustian, K., García-Oliva, F., Janzen, H. H., Jaramillo, V. J., Johnson, D. E., & Kulshreshtha, S. N. (2007). Chapter 10: Agricultural and Grazing Lands. In A. W. King, L. Dilling, G. P. Zimmerman, D. M. Fairman, R. A. Houghton, G. Marland, A. Z. Rose, & T. J. Wilbanks (Eds.), CCSP, 2007. The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (pp. 242). Asheville, NC: National Oceanic and Atmospheric Administration, National Climatic Data Center.

Connelly, J. W., Schroeder, M. A., Sands, A. R., & Braun, C. E. (2000). Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin, 28(4), 967-985.

Cook, R. C. (2011). A multi-regional evaluation of nutritional condition and reproduction in elk. (Doctor of Philosophy Phd), Washington State University.

Copeland, J. P., & Yates, R. E. (2006). Wolverine population assessment in Glacier National Park. Retrieved from Missoula, MT: No URL found

Copeland, J. P., McKelvey, K. S., Aubry, K. B., Landa, A., Persson, J., Inman, R. M., . . . May, R. (2010). The bioclimatic envelope of the wolverine (Gulo gulo): do climatic constraints limit its geographic distribution? Canadian Journal of Zoology, 88(3), 233-246. doi:10.1139/Z09-136

Copeland, J. P., Peek, J. M., Groves, C. R., Melquist, N. E., Mckelvey, K. S., Mcdaniel, G. W., . . . Harris, C. E. (2007). Seasonal habitat associations of the wolverine in central Idaho. Journal of Wildlife Management, 71(7), 2201-2212. doi:10.2193/2006-559

COSEWIC. (2010). Assessment and Status Report on the Flammulated owl (Otus flammeolus) in Canada. Retrieved from Ottawa, Canada: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Flammulated%20Owl_0810_e.pdf

Costello, C. M., Mace, R. D., & Roberts, L. L. (2016). Grizzly bear demographics in the Northern Continental Divide Ecosystem, Montana: research results (2004–2014) and suggested techniques for management of mortality (in press). Retrieved from Helena, MT:

Costello, C.M., and L.L. Roberts. 2016. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2015. Montana Fish, Wildlife & Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.

Covington, W. W., & DeBano, L. F. (1994). Sustainable ecological systems: implementing an ecological approach to land management. 1993 July 12-15; Flagstaff, Arizona. Retrieved from Fort Collins, CO: http://www.fs.fed.us/rm/pubs_rm/rm_gtr247.pdf

Covington, W. W., Fule, P. Z., Moore, M. M., Hart, S. C., Kolb, T. E., Mast, J. N., . . . Wagner, M. R. (1997). Restoring ecosystem health in ponderosa pine forests of the southwest. Journal of Forestry, 95(4), 23-29.

Craigg, T. L., Adams, P. W., & Bennett, K. A. (2015). Soil Matters: Improving Forest Landscape Planning and Management for Diverse Objectives with Soils Information and Expertise. Journal of Forestry, 113(3), 343-353. doi:10.5849/jof.14-083

Craighead, J. J., & Mitchell, J. A. (1982). Grizzly Bear. In J. A. Chapman & G. A. Feldhamer (Eds.), Wild Mammals of North America, First edition (pp. 515-556). Baltimore, MD: The Johns Hopkins University Press.

Craighead, J. J., Sumner, J. S., & Scaggs, G. B. (1982). A definitive system for analysis of grizzly bear habitat and other wilderness resources: utilizing LANDSAT multispectral imagery and computer technology. Missoula, MT: U of M Foundation, University of Montana.

Crane, K. K., Mosley, J. C., Brewer, T. K., Torstenson, W. L., & Tess, M. W. (2001). The influence of cattle grazing on elk forage conditions and habitat selection. In: Proceedings, American Society of Animal Science, Western Section. June 20–22, 2001. Montana State University, Bozeman. Abstracts: Journal of Animal Science Vol. 79, Supplement 2, page 115. Retrieved from Bozeman, MT: https://www.asas.org/membership-services/asas-sections/western-section/programs-proccedings-abstracts; http://www.asas.org/docs/western-section/2001abswestern.pdf?sfvrsn=0

CSKT. (2014). Final Environmental Impact Statement, Proposed Strategies to Benefit Native Species by Reducing the Abundance of Lake Trout Flathead Lake, Montana. Retrieved from http://www.mackdays.com/resources/Management-Uploads/Flathead-Lake-_LakeTrout-FEIS.pdf; https://www.federalregister.gov/articles/2014/02/21/2014-03722/final-environmental-impact-statement-for-proposed-strategies-to-benefit-native-species-by-reducing

CTKW. (2014). Section 1: Climate Change and Indigenous Peoples: A Primer. Section 2: Traditional Knowledges Guidelines. Retrieved from https://climatetkw.wordpress.com/; https://nccwsc.usgs.gov/acccnrs

Cushman, S. A., & Landguth, E. L. (2012). Ecological associations, dispersal ability, and landscape connectivity in the northern Rocky Mountains. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/40438

Cushman, S. A., McKelvey, K. S., Flather, C. H., & McGarigal, K. (2008). Do forest community types provide a sufficient basis to evaluate biological diversity? Frontiers in Ecology and the Environment, 6(1), 13-17. doi:10.1890/070039

Cushman, S. A., Raphael, M. G., Ruggiero, L. F., Shirk, A. S., Wasserman, T. N., & O'Doherty, E. C. (2011). Limiting factors and landscape connectivity: the American marten in the Rocky Mountains. Landscape Ecology, 26(8), 1137-1149. doi:10.1007/s10980-011-9645-8

Czaplewski, R.L. (2004). Application of forest inventory and analysis (FIA) data to estimate the amount of old growth forest and snag density in the Northern Region of the National Forest System. Unpublished report, on file with USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 13 p.

Czaplewski, R.L. (2004). Application of forest inventory and analysis (FIA) data to estimate the amount of old growth forest and snag density in the Northern Region of the National Forest System. Unpublished report, on file with USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 13 p.

Dahl, T. E. (1990). Wetland Losses in the United States 1780's to 1980's. Retrieved from Washington, D.C.: http://www.fws.gov/wetlands/Documents/Wetlands-Losses-in-the-United-States-1780s-to-1980s.pdf

Dale, V. H., Brown, S., Haeuber, R. A., Hobbs, N. T., Huntly, N., Naiman, R. J., . . . Valone, T. J. (2000). Ecological principles and guidelines for managing the use of land. Ecological Applications, 10(3), 639-670. doi:10.1890/1051-0761(2000)010[0639:EPAGFM]2.0.CO;2

Dale, V. H., Joyce, L. A., McNulty, S., Neilson, R. P., Ayres, M. P., Flannigan, M. D., . . . Wotton, B. M. (2001). Climate change and forest disturbances. Bioscience, 51(9), 723-734. doi:10.1641/0006-3568(2001)051[0723:Ccafd]2.0.Co;2

Dale, V.H, L.A. Joyce, S. McNulty, R.P. Neilson, M.P. Ayres, M.D. Flannigan, P.J. Hanson, L.C. Irland, A.E. Lugo, C.J. Peterson, D. Simberloff, F.J. Swanson, B.J. Stocks, and B.M. Wotton. 2001. Climate change and forest disturbances. BioScience 51:723–734.

Dale, V.H, L.A. Joyce, S. McNulty, R.P. Neilson, M.P. Ayres, M.D. Flannigan, P.J. Hanson, L.C. Irland, A.E. Lugo, C.J. Peterson, D. Simberloff, F.J. Swanson, B.J. Stocks, and B.M. Wotton. 2001. Climate change and forest disturbances. BioScience 51:723–734.

Davidson, E. A., Belk, E., & Boone, R. D. (1998). Soil water content and temperature as independent or confounded factors controlling soil respiration in a temperate mixed hardwood forest. Global Change Biology, 4(2), 217-227. doi:10.1046/j.1365-2486.1998.00128.x

Davis, K. M., Clayton, B. D., & Fischer, W. C. (1980). Fire ecology of Lolo National Forest habitat types. Retrieved from Ogden, UT: http://content.lib.umt.edu/cdm/ref/collection/forest/id/382.

Davis, S. K., Fisher, R. J., Skinner, S. L., Shaffer, T. L., & Brigham, R. M. (2013). Songbird abundance in native and planted grassland varies with type and amount of grassland in the surrounding landscape. Journal of Wildlife Management, 77(5), 908-919. doi:10.1002/jwmg.537

DeCesare, N. J., & Pletscher, D. H. (2006). Movements, connectivity, and resource selection of Rocky Mountain bighorn sheep. Journal of Mammalogy, 87(3), 531-538. doi:http://dx.doi.org/10.1644/05-MAMM-A-259R1.1

DeCesare, N. J., Smucker, T. D., Garrott, R. A., & Gude, J. A. (2014). Moose Status and Management in Montana. Alces, 50, 35-51.

DelCurto, T., Porath, M., Parsons, C. T., & Morrison, J. A. (2005). Management strategies for sustainable beef cattle grazing on forested rangelands in the Pacific Northwest. Rangeland Ecology and Management, 58(2), 119-127. doi:10.2111/1551-5028(2005)58<119:Msfsbc>2.0.Co;2

DeLuca, T. H., & Aplet, G. H. (2008). Charcoal and carbon storage in forest soils of the Rocky Mountain West. Frontiers in Ecology and the Environment, 6(1), 18-24. doi:10.1890/070070

Denman, K. L., Brasseur, G., Chidthaisong, A., Ciais, P., Cox, P. M., Dickinson, R. E., . . . Zhang, X. (2007). Couplings Between Changes in the Climate System and Biogeochemistry. In S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, & H. L. Miller (Eds.), Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY: Cambridge University Press.

DEQ. (2010). Montana / Idaho Airshed Group Operating Guide. Retrieved from http://www.smokemu.org/docs/2010%20Operations%20Guide.pdf

Dieni, J. S., & Jones, S. L. (2003). Grassland songbird nest site selection patterns in northcentral Montana. Wilson Bulletin, 115(4), 388-396. doi:http://dx.doi.org/10.1676/03-055

Chapter 3 Dietz, M.S., Belote, R.T., Aplet G.H., and Aycrigg, J.L. (2015) The world's largest wilderness protection netcork after 50 years: An assessment of ecological system representation in the U>S. National Wilderness Preservation System. Biological Conservation: http://www.sciencedirect.com/science/article/pii/S0006320715000944

Chapter 4 DiTomaso, J. M., & Johnson, D. W. (2006). The use of fire as a tool for controlling invasive plants. Retrieved from Berkeley, CA: https://www.firescience.gov/projects/06-S-01/project/06-S-01_final_report.pdf

Dixon, R. D., & Saab, V. A. (2000). Black-backed woodpecker (Picoides arcticus), Issue Number 509. In A. Poole (Ed.), The Birds of North America Online. Ithaca, NY: The Birds of North America, Inc. and Cornell Lab of Ornithology.

Dobson, F. S., & Jones, W. T. (1985). Multiple Causes of Dispersal. American Naturalist, 126(6), 855-858.

Doerr, S. H., Shakesby, R. A., Blake, W. H., Chafer, C. J., Humphreys, G. S., & Wallbrink, P. J. (2006). Effects of differing wildfire severities on soil wettability and implications for hydrological response. Journal of Hydrology, 319(1-4), 295-311. doi:10.1016/j.jhydrol.2005.06.038

Dood, A. R., Atkinson, S. J., & Boccadori, V. J. (2006). Grizzly Bear Management Plan for Western Montana: final programmatic environmental impact statement 2006-2016. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/managementPlan.html

DuBois, K. (2016). Bald eagle nesting populations and nest monitoring, 1980-2014. Final Report. Retrieved from http://fwp.mt.gov/fishAndWildlife/fishAndWildlifeLibrarySearch.html?selectedPage=&author=dubois&title=&year=2016&search=Search

Duda, M. D., De Michele, P. E., Bissell, S. J., Wang, P., Herrick, J., Lanier, A., . . . Zurawski, C. (2001). Public Attitudes Toward Grizzly Bear Management in Wyoming. Retrieved from http://www.responsivemanagement.com/wildlifereports.php

Dunham, J. B., Rieman, B. E., & Peterson, J. T. (2002). Patch based models to predict species occurrence: lessons from salmonid fishes in streams, Chapter 26, pages 327-334. In J. M. Scott, P. J. Heglund, M. Morrison, M. Raphael, J. Haufler, & B. Wall (Eds.), Predicting Species Occurrences: Issues of Scale and Accuracy. Covelo, CA: Island Press.

Dunham, J. B., Rosenberger, A. E., Luce, C. H., & Rieman, B. E. (2007). Influences of wildfire and channel reorganization on spatial and temporal variation in stream temperature and the distribution of fish and amphibians. Ecosystems, 10(2), 335-346. doi:10.1007/s10021-007-9029-8

Dunham, J. B., Young, M. K., Gresswell, R. E., & Rieman, B. E. (2003). Effects of fire on fish populations: landscape perspectives on persistence of native fishes and nonnative fish invasions. Forest Ecology and Management, 178(1-2), 183-196. doi:10.1016/S0378-1127(03)00061-6

Dwire, K. A., & Kauffman, J. B. (2003). Fire and riparian ecosystems in landscapes of the western USA. Forest Ecology and Management, 178(1-2), 61-74. doi:10.1016/S0378-1127(03)00053-7

Egerton-Warburton, L., Graham, E. C., & Hendrix, P. F. (2005). Soil ecosystem indicators of post-fire recovery in the California chaparral. Final Report to the National Commission on Science for Sustainable Forestry. Retrieved from Chicago, IL: http://ncseonline.org/sites/default/files/C4.1_overview_final.pdf

Elliot, W. J., Hall, D. E., & Graves, S. R. (1999). Predicting Sedimentation from Forest Roads. Journal of Forestry, 97(8), 23-29.

Elliot, W. J., Miller, I. S., & Audin, L. (2010). Cumulative watershed effects of fuel management in the western United States. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Ellison, A. M., Bank, M. S., Clinton, B. D., Colburn, E. A., Elliott, K., Ford, C. R., . . . Webster, J. R. (2005). Loss of foundation species: consequences for the structure and dynamics of forested ecosystems. Frontiers in Ecolology and Environment, 3(9), 479-486.

EPA. (1998). Interim Air Quality Policy on Wildland and Prescribed Fires. Retrieved from http://www3.epa.gov/ttn/caaa/t1/memoranda/firefnl.pdf

EPA. (2009). Frequently asked questions about global warming and climate change: Back to basics. Retrieved from http://www3.epa.gov/climatechange/Downloads/ghgemissions/Climate_Basics.pdf

Erickson, H. E., & White, R. (2008). Soils under fire: soils research and the Joint Fire Science Program. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/29927; http://www.fs.fed.us/pnw/pubs/pnw_gtr759.pdf.

Evans, D. M., & Finch, D. M. (1994). Relationships between forest songbird populations and managed forests in Idaho. In W. W. Covington & L. F. Debano (Eds.), Sustainable ecological systems: implementing an ecological approach to land management, General Technical Report RM-247 (pp. 308-314). Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Evenden, A. G., Moeur, M., Shelly, J. S., Kimball, S. F., & Wellner, C. A. (2001). Research Natural Areas on National Forest System Lands in Idaho, Montana, Nevada, Utah, and Western Wyoming: A

Guidebook for Scientists, Managers, and Educators. Retrieved from Ogden, UT: http://www.fs.fed.us/rm/pubs/rmrs_gtr069.pdf

Evers, D. C. (2004). Status Assessment and Conservation Plan for The Common Loon (Gavia immer) in North America: Final Draft. Retrieved from Hadley, MA: http://wdfw.wa.gov/conservation/loons/common_loon_status_assessment.pdf

Evers, D. C. (2014). Conserve the Call: Identifying and Managing Environmental Threats to the Common Loon. Retrieved from Portland, Maine: http://www.briloon.org/uploads/Library/item/266/file/ConserveTheCall.pdf

Executive Order 13112 Invasive Species, 64(25) C.F.R. (1999).

Fagre, D. B., Peterson, D. L., & Hessl, A. E. (2003). Taking the pulse of mountains: ecosystem responses to climatic variability. Climatic Change, 59(1-2), 263-282. doi:10.1023/A:1024427803359

Farnes, P. E. (1990). SNOTEL and snow course data describing the hydrology of whitebark pine ecosystems. In: Proceedings-Symposium on Whitebark Pine Ecosystems: Ecology and Management of a High-Mountain Resource. Retrieved from Bozeman, MT: http://www.fs.fed.us/rm/pubs_int/int_gtr270.pdf

Fausch, K. D., Rieman, B. E., Dunham, J. B., Young, M. K., & Peterson, D. P. (2009). Invasion versus Isolation: Trade-Offs in Managing Native Salmonids with Barriers to Upstream Movement. Conservation Biology, 23(4), 859-870. doi:10.1111/j.1523-1739.2008.01159.x

Fausch, K. D., Torgersen, C. E., Baxter, C. V., & Li, H. W. (2002). Landscapes to riverscapes: Bridging the gap between research and conservation of stream fishes. Bioscience, 52(6), 483-498. doi:10.1641/0006-3568(2002)052[0483:Ltrbtg]2.0.Co;2

FEIS http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5133660.pdf

Feld, C.K, and C.W. Lorenz. 2013. Upstream river morphology and riparian land use overrule local restoration effects on ecological status assessment. Hydrobiologia, 704:489–501. DOI 10.1007/s10750-012-1326-3

Fellers, G. M., & Pierson, E. D. (2002). Habitat use and foraging behavior of Townsend's big-eared bat (Corynorhinus townsendii) in coastal California. Journal of Mammalogy, 83(1), 167-177. doi:10.1644/1545-1542(2002)083<0167:Huafbo>2.0.Co;2

Fettig, C. J., Klepzig, K. D., Billings, R. F., Munson, A., Nebeker, T., Negrón, J. F., & Nowak, J. T. (2007). The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. Forest Ecology & Management, 238(1-3), 24-53.

Fettig, C. J., Klepzig, K. D., Billings, R. F., Munson, A., Nebeker, T., Negrón, J. F., & Nowak, J. T. (2007). The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. Forest Ecology & Management, 238(1-3), 24-53.

Fiedler, C. E., & McKinney, S. T. (2014). Forest Structure, Health, and Mortality in Two Rocky Mountain Whitebark Pine Ecosystems: Implications for Restoration. Natural Areas Journal, 34(3), 290-299. doi:http://dx.doi.org/10.3375/043.034.0305

Finch, D. M. (2012). Climate change in grasslands, shrublands, and deserts of the interior American West: a review and needs assessment. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/41171; http://www.fs.fed.us/rm/pubs/rmrs_gtr285.pdf

Finney, M. A. (2007). A computational method for optimising fuel treatment locations. International Journal of Wildland Fire, 16(6), 702-711. doi:http://dx.doi.org/10.1071/WF06063

Finney, M. A., & Cohen, J. D. (2003). Expectation and evaluation of fuel management objectives. In P. N. Omi & L. A. Joyce (Eds.), Fire, fuel treatments, and ecological restoration: Conference proceedings; 2002 16-18 April; Fort Collins, CO. Proceedings RMRS-P-29 (pp. 353-366). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Finney, M.A. (2007). A conceptual method for optimizing fuel treatment locations. International Journal of Wildland Fire, 16, 702-711.

Finney, M.A. (2007). A conceptual method for optimizing fuel treatment locations. International Journal of Wildland Fire, 16, 702-711.

Finney, M.A., & Cohen, J.D. (2003). Expectation and evaluation of fuel management objectives. In P.N. Omi (Ed.), Proceedings of Fire, Fuel Treatments, and Ecological Restoration, April 14-17, Ft. Collins, CO (pp 353-366). USDA Forest Service.

Finney, M.A., & Cohen, J.D. (2003). Expectation and evaluation of fuel management objectives. In P.N. Omi (Ed.), Proceedings of Fire, Fuel Treatments, and Ecological Restoration, April 14-17, Ft. Collins, CO (pp 353-366). USDA Forest Service.

Fisher, J. T., & Wilkinson, L. (2005). The response of mammals to forest fire and timber harvest in the North American boreal forest. Mammal Review, 35(1), 51-81. doi:10.1111/j.1365-2907.2005.00053.x

Fletcher, K., & Freedman, B. (1986). Effects of the Herbicides Glyphosate, 2,4,5-Trichlorophenoxyacetic Acid, and 2,4-Dichlorophenoxyacetic Acid on Forest Litter Decomposition. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 16(1), 6-9. doi:10.1139/x86-002

Forcella, F. (1978). Flora and chorology of the Pinus albicaulis-Vaccinium scoparium association. Madrono, 25, 139-150.

Forristal, C. D. (2009). Influence of postfire salvage logging on Black-backed woodpecker nest-site selection and nest survival. (Master of Science), Montana State University, Bozeman, MT. Retrieved from http://scholarworks.montana.edu/xmlui/bitstream/1/1269/1/ForristalC0509.pdf

Fraley, J. J., & Shepard, B. B. (1989). Life-history, ecology and population status of migratory bull trout (Salvelinus confluentus) in the Flathead Lake and River system, Montana. Northwest Science, 63(4), 133-143.

Franklin, J. F., Spies, T. A., Van Pelt, R., Carey, A. B., Thornburgh, D. A., Berg, D. R., . . . Chen, J. (2002). Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forests as an example. Forest Ecology and Management, 155(1-3), 399-423. doi:10.1016/S0378-1127(01)00575-8

Franzreb, K. E., & Laymon, S. A. (1993). A Reassessment of the Taxonomic Status of the Yellow-billed Cuckoo. Western Field Ornithologists, 24(1), 28.

Friedlingstein, P., Cox, P., Betts, R., Bopp, L., Von Bloh, W., Brovkin, V., . . . Zeng, N. (2006). Climate–Carbon Cycle Feedback Analysis: Results from the C4MIP Model Intercomparison. Journal of Climate, 19(14), 3337-3353. doi:http://dx.doi.org/10.1175/JCLI3800.1

Fritts, S. H., Bangs, E. E., & Gore, J. F. (1994). The Relationship of Wolf Recovery to Habitat Conservation and Biodiversity in the Northwestern United-States. Landscape and Urban Planning, 28(1), 23-32. doi:10.1016/0169-2046(94)90040-X

Fryer, J. L. (2002). Pinus albicaulis. In: Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [2016, January 26]. Retrieved from Missoula, MT: http://www.fs.fed.us/database/feis/plants/tree/pinalb/all.html

Fuller, P. R. (1976). Browse production and utilization on Spotted Bear Mountain winter range and seasonal movements of the Spotted Bear elk herd. (Master of Science), University of Montana, Missoula, MT.

Fuller, T. K. (1989). Population-Dynamics of Wolves in North-Central Minnesota. Wildlife Monographs(105), 3-41.

Furniss, M. J., Love, M., Firor, S., Llanos, A., Moynan, K., Guntle, J., & Gubernick, R. (2009). FishXing, version 3.0b. Software and learning systems for fish passage through culverts. Aquatic Organism Passage (AOP). Retrieved from http://www.stream.fs.fed.us/fishxing/

Furniss, M. J., Roelofs, T. D., & Yee, C. S. (1991). Road Construction and Maintenance. In W. R. Meehan (Ed.), Pages 297-323. In: Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats (pp. 622): American Fisheries Society, Special Publication 19.

Furniss, M. J., Staab, B. P., Hazelhurst, S., Clifton, C. F., Roby, K. B., Ilhadrt, B. L., . . . Edwards, P. J. (2010). Water, climate change, and forests: watershed stewardship for a changing climate. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/35295; http://www.fs.fed.us/pnw/pubs/pnw_gtr812.pdf.

Gage, E., & Cooper, D. J. (2013). Historical range of variation assessment for wetland and riparian ecosystems, U.S. Forest Service Rocky Mountain Region. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/43268; http://www.fs.fed.us/rm/pubs/rmrs_gtr286.pdf.

Galik, C. S., & Jackson, R. B. (2009). Risks to forest carbon offset projects in a changing climate. Forest Ecology and Management, 257(11), 2209-2216. doi:10.1016/j.foreco.2009.03.017

Genter, D. L., & Jurist, K. A. (1995). Bats of Montana. Retrieved from Helena, MT: http://mtnhp.org/Reports.asp?key=7; http://mtnhp.org/animal/reports/mammals/batsummary.pdf.

Gibeau, M. L., Clevenger, A. P., Herrero, S., & Wierzchowski, J. (2002). Grizzly bear response to human development and activities in the Bow River Watershed, Alberta, Canada. Biological Conservation, 103(2), 227-236. doi:10.1016/S0006-3207(01)00131-8

Giddings, B. (2009). Furbearer Program Statewide Harvest and Management Report 2008-09, Montana. Retrieved from Helena, MT: http://fwp.mt.gov/hunting/trapping/default.html

Giddings, B. (2013). Furbearer Program, 2011-12 Statewide Harvest and Management Report. Retrieved from Helena, MT: http://fwp.mt.gov/hunting/trapping/; http://fwp.mt.gov/hunting/planahunt/harvestReports.html#furbearer

GNP. (2013). 2013 Black Swift Surveys, Glacier National Park. Retrieved from MT:

Goheen, E. M., & Sniezko, R. A., (tech. coords). (2006). Whitebark Pine: A Pacific Coast Perspective, Ashland, Oregon.

Gomez, A., Powers, R. F., Singer, M. J., & Horwath, W. R. (2002). Soil compaction effects on growth of young ponderosa pine following litter removal in California's Sierra Nevada. Soil Science Society of America Journal, 66(4), 1334-1343. doi:10.2136/sssaj2002.1334

Goode, J. R., Luce, C. H., & Buffington, J. M. (2012). Enhanced sediment delivery in a changing climate in semi-arid mountain basins: Implications for water resource management and aquatic habitat in the northern Rocky Mountains. Geomorphology, 139, 1-15. doi:10.1016/j.geomorph.2011.06.021

Grace III, J. M., & Clinton, B. D. (2007). Protecting soil and water inforest road management. American Society of Agricultural and Biological Engineers, 50(5), 1579-1584.

Graham, R. T., Harvey, A. E., Jurgensen, M. F., Jain, T. B., Tonn, J. R., & Page-Dumroese, D. S. (1994). Managing coarse woody debris in forests of the Rocky Mountains. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/24829; http://www.fs.fed.us/rm/pubs_int/int_rp477.pdf

Grant, G. E., Lewis, S. L., Swanson, F. J., Cissel, J. H., & McDonnell, J. J. (2008). Effects of forest practices on peak flows and consequent channel response: a state-of-science report for western Oregon and Washington. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/30179; http://www.fs.fed.us/pnw/pubs/pnw_gtr760.pdf

Green P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old growth forest types of the Northern Region. Errata corrected 2005, 2007, 2008. USDA Forest Service, Northern Region Document Number R-1 SES 4/92. Missoula, MT. 609 pp.

Green P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old growth forest types of the Northern Region. Errata corrected 2005, 2007, 2008. USDA Forest Service, Northern Region Document Number R-1 SES 4/92. Missoula, MT. 609 pp.

Green, M. G., Swem, T., Morin, M., Mesta, R., Klee, M., Hollar, K., . . . Amaral, M. (2006). Monitoring results for breeding American Peregrine Falcon (Falco peregrinus anatum), 2003. Retrieved from http://www.fws.gov/mountain-prairie/species/birds/apfalcon/Monitoring%20Results%20for%20Breeding%20American%20Peregrine%20Falcons.pdf

Green, P., Joy, J., Sirucek, D., Hann, W., Zack, A., & Naumann, B. (1992). Old-growth forest types of the Northern Region (errata corrected 2005, 2007, 2008, 2011). Retrieved from Missoula, MT: http://merid.org/~/media/Files/Projects/FNF/Habitat/OGForestTypes_GreenEtAl_1992_ExcerptsFNF

Gresswell, R. E. (1999). Fire and Aquatic Ecosystems in Forested Biomes of North America. Transactions of the American Fisheries Society, 128(2), 193-221. doi:10.1577/1548-8659(1999)128<0193:FAAEIF>2.0.CO;2

Griffin, P. C. (2004). Landscape ecology of snowshoe hares in Montana. (PhD), University of Montana, Missoula, MT. Retrieved from No URL found

Gruver, J. C., & Keinath, D. A. (2006). Townsend's Big-eared Bat (Corynorhinus townsendii): a technical conservation assessment. Retrieved from http://www.fs.fed.us/r2/projects/scp/assessments/townsendsbigearedbat.pdf

Gucinski, H., Furniss, M. J., Ziemer, R. R., & Brookes, M. H. (2001). Forest roads: a synthesis of scientific information. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/2922; http://www.fs.fed.us/pnw/pubs/pnw_gtr509.pdf

Gunn, C., Beason, J., Potter, K., & Webb, M. (2013). Black Swift (Cypseloides niger). Neotropical Birds Online, Ithaca: Cornell Lab of Ornithology. Retrieved from Retrieved from Neotropical Birds Online: http://neotropical.birds.cornell.edu/portal/species/overview?p_p_spp=224091

Guscio, C. G. (2007). Responses of western toads (Bufo boreas) to changes in terrestial habitat resulting from wildfire. (Master of Science), University of Montana, Missoula, MT. Retrieved from http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=1852&context=etd

Guscio, C. G., Hossack, B. R., Eby, L. A., & Corn, P. S. (2008). Post-Breeding Habitat Use by Adult Boreal Toads (Bufo Boreas) after Wildfire in Glacier National Park, USA. Herpetological Conservation and Biology, 3(1), 55-62.

Haak, A. L., Williams, J. E., Isaak, D., Todd, A., Muhlfeld, C., Kershner, J. L., . . . Neville, H. M. (2010). The potential influence of changing climate on the persistence of salmonids of the inland west. Retrieved from http://pubs.usgs.gov/of/2010/1236/pdf/OF10-1236.pdf

Haas, G. R., & McPhail, J. D. (1991). Systematics and distributions of dolly varden (Salvelinus malma) and bull trout (Salvelinus confluentus) in North America. Canadian Journal of Fisheries and Aquatic Sciences, 48(11), 2191-2211.

Haas, G. R., & McPhail, J. D. (2001). The post-Wisconsinan glacial biogeography of bull trout (Salvelinus confluentus): a multivariate morphometric approach for conservation biology and management. Canadian Journal of Fisheries and Aquatic Sciences, 58(11), 2189-2203. doi:10.1139/cjfas-58-11-2189

Halofsky, J. E., & Hibbs, D. E. (2008). Determinants of riparian fire severity in two Oregon fires, USA. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 38(7), 1959-1973. doi:10.1139/X08-048

Halofsky, J. E., & Hibbs, D. E. (2009). Controls on early post-fire woody plant colonization in riparian areas. Forest Ecology and Management, 258(7), 1350-1358. doi:10.1016/j.foreco.2009.06.038

Halofsky, J.E.; Peterson, D.L.; Hoang, L., eds. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. In press.

Halofsky, J.E.; Peterson, D.L.; Hoang, L., eds. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. In press.

Hamann, B., Hohnston, H., Gobielle, J., Hillis, M., Johnson, S., Kelly, L., & McClelland, P. (1999). Birds. In G. Joslin & H. Youmans (Eds.), Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana (pp. 3.1-3.34): Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Hammond, C. A. (2008). A Demographic and Landscape Analysis for Common Loons in Northwest Montana. (Master of Science), University of Montana, Missoula, MT. Retrieved from http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=1281&context=etd

Hammond, C. A. (2009). Conservation Plan for the Common Loon in Montana. Retrieved from Kalispell, MT: http://fwpiis.mt.gov/content/getItem.aspx?id=47666; Reed K. has pdf copy in wildlife folder.

Hammond, C. A. H. (2009). Conservation Plan for the Common Loon in Montana. Retrieved from Kalispell, Montana: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwi_s6GbtazKAhVP5mMKHcaGBEcQFggcMAA&url=http%3A%2F%2Ffwp.mt.gov%2FfwpDoc.html%3Fid%3D47666&usg=AFQjCNG4Sj3F8Q5OSTH_Jrl5Rb3YHqTKzQ&bvm=bv.112064104,d.cGc

Hammond, C. A. M., Mitchell, M. S., & Bissell, G. N. (2012). Management and Conservation: Territory Occupancy by Common Loons in Response to Disturbance, Habitat, and Intraspecific Relationships. The Journal of Wildlife Management, 76(3), 645–651. doi:10.1002/jwmg.298

Han, S.-K., Han, H.-S., Page-Dumroese, D. S., & Johnson, L. R. (2009). Soil compaction associated with cut-to-length and whole-tree harvesting of a coniferous forest. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 39(5), 976-989. doi:10.1139/X09-027

Hand, M. S., & Lawson, M. NRAP Chapter 10: Effects of Climate Change on Recreation (Draft for Review) (pp. 26).

Hann, W. J., Jones, J. L., Karl, M. G. S., Hessburg, P. F., Keane, R. E., Long, D. G., . . . Smith, B. G. (1997). (Excerpts from) CHAPTER 3: Landscape Dynamics of the Basin. In T. M. Quigley & S. J. Arbelbide (Eds.), An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: General Technical Report PNW-GTR-405 (Vol. 2, pp. 338-1055). Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Hansen, A. J., Knight, R. L., Marzluff, J. M., Powell, S., Brown, K., Gude, P. H., & Jones, K. (2005). Effects of exurban development on biodiversity: Patterns, mechanisms, and research needs. Ecological Applications, 15(6), 1893-1905. doi:10.1890/05-5221

Hansen, R. M., & Reid, L. D. (1975). Diet Overlap of Deer, Elk, and Cattle in Southern Colorado. Journal of Range Management, 28(1), 43-47. doi:10.2307/3897577

Hansen, W. K. (2014). Causes of Annual Reproductive Variation and Anthropogenic Disturbance in Harlequin Ducks Breeding in Glacier National Park, Montana. (Master of Science), University of Montana, Missoula, MT. Retrieved from http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=5313&context=etd

Hanski, I., & Gilpin, M. E. (1997). Metapopulation Biology. San Diego: Academic Press.

Hardy, C. C., & Arno, S. F. (1996). The Use of Fire in Forest Restoration. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/27534; http://www.fs.fed.us/rm/pubs_int/int_gtr341.pdf

Harig, A. L., & Fausch, K. D. (2002). Minimum habitat requirements for establishing translocated cutthroat trout populations. Ecological Applications, 12(2), 535-551. doi:10.1890/1051-0761(2002)012[0535:Mhrfet]2.0.Co;2

Harmon, M. E., & Marks, B. (2002). Effects of silvicultural practices on carbon stores in Douglas-fir-western hemlock forests in the Pacific Northwest, USA: results from a simulation model. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 32(5), 863-877. doi:10.1139/X01-216

Harrington, M. G. (1996). Prescribed fire applications: Restoring ecological structure and process in ponderosa pine forests, page 41. In: Hardy, Colin C.; Arno, Stephen F., eds. The use of fire in forest restoration. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/28488; http://www.fs.fed.us/rm/pubs_int/int_gtr341/int_gtr341_041.pdf; http://www.treesearch.fs.fed.us/pubs/27534; http://www.fs.fed.us/rm/pubs_int/int_gtr341.pdf

Harrower, W. L., Larsen, K. W., & Stuart-Smith, K. A. (2010). Movements and Resource Selection of Fledgling Goshawks in Montane Forests of Southeastern British Columbia. Journal of Wildlife Management, 74(8), 1768-1775. doi:10.2193/2009-127

Hart, S. C., DeLuca, T. H., Newman, G. S., MacKenzie, M. D., & Boyle, S. I. (2005). Post-fire vegetative dynamics as drivers of microbial community structure and function in forest soils. Forest Ecology and Management, 220(1-3), 166-184. doi:10.1016/j.foreco.2005.08.012

Hartford, R. A., & Frandsen, W. H. (1992). When It's Hot, It's Hot ... or Maybe It's Not! (Surface Flaming May Not Portend Extensive Soil Heating). International Journal of Wildland Fire, 2(3), 139-144.

Harvey, A. E., Jurgensen, M. F., Larsen, M. J., & Graham, R. T. (1987). Decaying organic materials and soil quality in the Inland Northwest: A management opportunity. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/39575; http://www.fs.fed.us/rm/pubs_int/int_gtr225.pdf

Hayward, G. D., & Escano, R. E. (1989). Goshawk Nest-Site Characteristics in Western Montana and Northern Idaho. The Condor, 91(2), 476-479. doi:10.2307/1368330

Hayward, G. D., & Verner, J. (1994). Flammulated, boreal, and great gray owls in the United States: A Technical Conservation Assessment. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/28773; http://www.fs.fed.us/rm/pubs_rm/rm_gtr253.pdf

Headwaters-Economics. (2011). The Effects of Climate Change on Downhill Skiing and Recreational Fishing in the Crown of the Continent. Retrieved from Bozeman, Montana: http://headwaterseconomics.org/

Heath, L. S., Smith, J. E., Woodall, C. W., Azuma, D. L., & Waddell, K. L. (2011). Carbon stocks on forestland of the United States, with emphasis on USDA Forest Service ownership. Ecosphere, 2(1). doi:10.1890/Es10-00126.1

Hebel, C. L., Smith, J. E., & Cromack, K. (2009). Invasive plant species and soil microbial response to wildfire burn severity in the Cascade Range of Oregon. Applied Soil Ecology, 42(2), 150-159. doi:10.1016/j.apsoil.2009.03.004

Hegg, S. J., Murphy, K., & Bjornlie, D. (2010). Grizzly bears and snowmobile use: a summary of monitoring a grizzly bear den on Togwotee Pass. Yellowstone Science, 18(2), 23-28.

Heinemeyer, K. (2012). Central Idaho Wolverine and Winter Recreation Research Study, February, 2012, Project Update.

Heinemeyer, K., & Squires, J. R. (2013). Wolverine – Winter Recreation Research Project: Investigating the Interactions between Wolverines and Winter Recreation. Retrieved from http://wolverinefoundation.org/wp-content/uploads/2014/03/Final-Idaho-Wolverine-Winter-Recreation-Project-2013-Progress-Report-16Nov13.pdf

Hejl, S. J. (2000). A Strategy for Maintaining Healthy Populations of Western Coniferous Forest Birds. In R. Bonney, D. N. Pashley, R. J. Cooper, & L. Niles (Eds.), Strategies for bird conservation: The Partners in Flight planning process; Proceedings of the 3rd Partners in Flight Workshop. RMRS-P-16 (pp. 97-102). Cape May, NJ: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Hejl, S. J., & Paige, L. C. (1994). A preliminary assessment of birds in continuous and fragmented forests of western redcedar/western hemlock in northern Idaho. In D. M. Baumgartner, J. E. Lotan, & J. R. Tonn (Eds.), Proceedings of a symposium on interior cedar-hemlock-white pine forests: ecology and management (pp. 189-197). Pullman, WA: Washington State University.

Heller, N. E., & Zavaleta, E. S. (2009). Biodiversity management in the face of climate change: A review of 22 years of recommendations. Biological Conservation, 142(1), 14-32. doi:10.1016/j.biocon.2008.10.006

Hendricks, P. (2005). Surveys for animal species of concern in northwestern Montana. Retrieved from Helena, MT: http://mtnhp.org/Reports.asp?key=9; https://archive.org/details/60AD4B1E-A917-4BBC-BA59-887AAA9C3B7E

Hendricks, P., & Maxell, B. A. (2005). Bat Surveys on USFS Northern Region Lands in Montana: 2005. Retrieved from Helena, MT: http://mtnhp.org/Reports.asp?key=7; https://archive.org/details/C26F4981-9BB9-40DA-AA60-B3369E23F6CA; http://www.biodiversitylibrary.org/bibliography/57344#/summary

Hessburg, P. F., Salter, B. G., Ottmar, R. D., & Alvarado, E. E. (2000). Recent changes (1930s-1990s) in spatial patterns of interior northwest forest, USA. Forest Ecology & Management, 136(1-3), 53.

Hessburg, P. F., Salter, B. G., Ottmar, R. D., & Alvarado, E. E. (2000). Recent changes (1930s-1990s) in spatial patterns of interior northwest forest, USA. Forest Ecology & Management, 136(1-3), 53.

Hessburg, P. F., Salter, R. B., & James, K. M. (2007). Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecology, 22, 5-24. doi:10.1007/s10980-007-9098-2

Hessburg, P.F., Smith, B.G., Kreiter, S.D., Miller, C.A., Salter, R.B., McNicoll, C.H., & Hann, W.J. (1999). Historical and current forest and range landscapes in the interior Columbia River basin and portions of the Klamath and Great Basins; Part I: Linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. Gen. Tech. Rep. PNW-GTR-458. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 357 p.

Hessburg, P.F., Smith, B.G., Kreiter, S.D., Miller, C.A., Salter, R.B., McNicoll, C.H., & Hann, W.J. (1999). Historical and current forest and range landscapes in the interior Columbia River basin and portions of the Klamath and Great Basins; Part I: Linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. Gen. Tech. Rep. PNW-GTR-458. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 357 p.

Hicke, J. A., Allen, C. D., Desai, A. R., Dietze, M. C., Hall, R. J., Hogg, E. H., . . . Vogelmann, J. (2012). Effects of biotic disturbances on forest carbon cycling in the United States and Canada. Global Change Biology, 18(1), 7-34. doi:10.1111/j.1365-2486.2011.02543.x

Hicke, Jeffery A., Craig D. Allen, Ankur R. Desai, Michael C. Dietze, Ronald J. Hall, Edward H (Ted) Hogg, Daniel M. Kashiam, David Moore, Kenneth F. Raffa, Rona N. Sturrock, and James Vogelmann. 2012. Effects of biotic disturbances on forest carbon cycling in the United States and Canada. Global Change Biology (2012) 18, 7-34, doi: 10.1111/j.1365-2496.2011.02543x

Hicke, Jeffery A., Craig D. Allen, Ankur R. Desai, Michael C. Dietze, Ronald J. Hall, Edward H (Ted) Hogg, Daniel M. Kashiam, David Moore, Kenneth F. Raffa, Rona N. Sturrock, and James Vogelmann. 2012. Effects of biotic disturbances on forest carbon cycling in the United States and Canada. Global Change Biology (2012) 18, 7-34, doi: 10.1111/j.1365-2496.2011.02543x

High, B., Meyer, K. A., Schill, D. J., & Mamer, E. R. J. (2008). Distribution, Abundance, and Population Trends of Bull Trout in Idaho. North American Journal of Fisheries Management, 28(6), 1687-1701. doi:10.1577/M06-164.1

Hillis, J. M., & Lockman, D. (2003). American Marten Assessment. Retrieved from Missoula, MT: No URL

Hillis, J. M., Thompson, M. J., Canfield, J. E., Lyon, L. J., Marcum, C. L., Dolan, P. M., & McCleerey, D. W. (1991). Defining elk security: the Hillis paradigm. In A. G. Christensen, L. J. Lyon, & T. N. Lonner (Eds.), Pages 38-43. In: Proceedings of a Symposium on Elk Vulnerability (pp. 330). Bozeman, MT: Montana Department of Fish, Wildlife and Parks.

Hirshman, S. E., Gunn, C., & Levad, R. G. (2007). Breeding phenology and success of black swifts in Box Canyon, Ouray, Colorado. Wilson Journal of Ornithology, 119(4), 678-685. doi:http://dx.doi.org/10.1676/06-112.1

Hitt, N. P., Frissell, C. A., Muhlfeld, C. C., & Allendorf, F. W. (2003). Spread of hybridization between native westslope cutthroat trout, Oncorhynchus clarki lewisi, and nonnative rainbow trout, Oncorhynchus mykiss. Canadian Journal of Fisheries and Aquatic Sciences, 60(12), 1440-1451. doi:10.1139/F03-125

Hoff, R. J., Ferguson, D. E., McDonald, G. I., & Keane, R. E. (2001). Strategies for managing whitebark pine in the presence of white pine blister rust [Chapter 17]. In D. F. Tomback, S. F. Arno, & R. E. Keane (Eds.), Whitebark pine communities: Ecology and restoration (pp. 346-366). Washington, D.C.: Island Press.

Holden, Z. A., Swanson, A., Klene, A. E., Abatzoglou, J. T., Dobrowski, S. Z., Cushman, S. A., . . . Oyler, J. W. (2015). Development of high-resolution (250 m) historical daily gridded air temperature data using reanalysis and distributed sensor networks for the US Northern Rocky Mountains. International Journal of Climatology, n/a-n/a. doi:10.1002/joc.4580

Holling, C. S. (1987). Simplifying the Complex - the Paradigms of Ecological Function and Structure. European Journal of Operational Research, 30(2), 139-146. doi:10.1016/0377-2217(87)90091-9

Holling, C.S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology & Systematics, 41-23.

Holling, C.S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology & Systematics, 41-23.

Hornocker, M. G., & Hash, H. S. (1981). Ecology of the wolverine in northwestern Montana. Canadian Journal of Zoology, 59(7), 1286-1301. doi:10.1139/z81-181

Hossack, B. R., Lowe, W. H., Honeycutt, R. K., Parks, S. A., & Corn, P. S. (2013). Interactive effects of wildfire, forest management, and isolation on amphibian and parasite abundance. Ecological Applications, 23(2), 479-492.

Houghton, R. A. (2003). Revised estimates of the annual net flux of carbon to the atmosphere from changes in land use and land management 1850-2000. Tellus Series B-Chemical and Physical Meteorology, 55(2), 378-390. doi:10.1034/j.1600-0889.2003.01450.x

Houghton, R. A. (2005). Aboveground forest biomass and the global carbon balance. Global Change Biology, 11(6), 945-958. doi:10.1111/j.1365-2486.2005.00955.x

Housman, I., Brown, S., Hamilton, R., & Fisk, H. (2014). Whitebark pine single-species mapping. Retrieved from Salt Lake City, UT: http://www.fs.fed.us/eng/rsac/index.html

Hoyt, J. S. (2000). Habitat associations of Black-backed Picoides arcticus and Three-toed P. tridactylus woodpeckers in the northeastern boreal forest of Alberta. In R. D. Dixon & V. A. Saab (Eds.), Black-backed Woodpecker (Picoides arcticus), The Birds of North America Online (A. Poole, Ed.). Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/509. Ithaca, NY: Cornell Lab of Ornithology.

http://fsweb.r1.fs.fed.us/forest/inv/classify/r1_ex_veg_cmi_4_09.pdf

http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6BdkOyoCAPkATlA!/?ss=110116&navtype=BROWSEBYSUBJECT&cid=FSE_003756&navid=130100000000000&pnavid=130000000000000&position=BROWSEBYSUBJECT&ttype=main&pname=Lolo%2520National%2520Forest-%2520Planning

http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Grizzly_Bear_Recovery_Plan_March2013.pdf

https://ia801002.us.archive.org/2/items/soildisturbancer436clay/soildisturbancer436clay.pdf

https://ia902600.us.archive.org/10/items/CAT92991181/CAT92991181.pdf

Hubbart, J. A., Link, T. E., Gravelle, J. A., & Elliot, W. J. (2007). Timber harvest impacts on water yield in the continental/maritime hydroclimatic region of the United States. Forest Science, 53(2), 169-180.

Hunter, W. F., & Baldwin, P. H. (1962). Nesting of the Black Swift in Montana. The Wilson Bulletin, 74(4), 409-416.

Hunter, W. F., & Baldwin, P. H. (1972). Black Swift Nest in Glacier National Park. The Murrelet, 53(3 Sep.-Dec., 1972), 50-51.

Hutson, S. S., Barber, N. L., Kenny, J. F., Linsey, K. S., Lumia, D. S., & Maupin, M. A. (2005 (released March 2004, revised April 2004, May 2004, February 2005)). Estimated Use of Water in the

United States in 2000. Retrieved from Reston, VA: http://pubs.usgs.gov/circ/2004/circ1268/; http://pubs.usgs.gov/circ/2004/circ1268/pdf/circular1268.pdf

Hutto, R. L. (1995). Composition of Bird Communities Following Stand-Replacement Fires in Northern Rocky-Mountain (USA) Conifer Forests. Conservation Biology, 9(5), 1041-1058. doi:10.1046/j.1523-1739.1995.9051041.x

Hutto, R. L. (1995). Distribution and habitat relationships. Retrieved from Missoula, MT:

Hutto, R. L. (2008). The Ecological Importance of Severe Wildfires: Some Like It Hot. Ecological Applications, 18(8), 1827-1834. doi:10.1890/08-0895.1

Hutto, R. L., & Gallo, S. M. (2006). The effects of postfire salvage logging on cavity-nesting birds. Condor, 108(4), 817-831. doi:10.1650/0010-5422(2006)108[817:Teopsl]2.0.Co;2

Hutto, R. L., & Young, J. S. (1999). Habitat relationships of landbirds in the Northern Region, USDA Forest Service. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/37402; http://www.fs.fed.us/rm/pubs/rmrs_gtr032.pdf

Hutto, R. L., Bond, M. L., & DellaSala, D. A. (2015). Chapter 3 - Using bird ecology to learn about the benefits of severe fire. In D. A. DellaSala & C. T. Hanson (Eds.), The Ecological Importance of Mixed-Severity Fires: Nature's Phoenix (pp. 55-88): Elsevier, Inc.

Hutto, R. L., Hejl, S. J., Preston, C. R., & Finch, D. M. (1993). Effects of Silvicultural Treatments of Forest Birds in the Rocky Mountains: Implications and Management Recommendations, 386-391. Retrieved from http://www.treesearch.fs.fed.us/pubs/22803; http://www.fs.fed.us/rm/pubs_rm/rm_gtr229.pdf

ICBEMP. (1996). Interior Columbia River Basin Ecosystem Management Project (ICBEMP). Retrieved from http://www.fs.fed.us/pnw/publications/icbemp.shtml; http://www.icbemp.gov/science/scipubs.shtml

ICBEMP. (1997). Draft Environmental Impact Statement (Draft EIS), Interior Columbia Basin Ecosystem Management Project. Retrieved from http://www.icbemp.gov/eis/eis_doc.shtml

ICBEMP. (2001). Final Environmental Impact Statement (Final EIS) and the proposed decision, Interior Columbia Basin Ecosystem Management Project. Retrieved from http://www.icbemp.gov/eis/eis_doc.shtml; http://www.icbemp.gov/pdfs/feispdfs/feis.htm

IDFG. (2014). Management Plan for the Conservation of Wolverines in Idaho. Retrieved from Boise, ID: http://fishandgame.idaho.gov/public/wildlife/?getPage=249; http://fishandgame.idaho.gov/public/wildlife/planWolverine.pdf

IGBC. (1986). Interagency Grizzly Bear Guidlines. Retrieved from http://www.igbconline.org/images/pdf/IGBC_Guidelines.pdf

IGBC. (1998). Interagency Grizzly Bear Committee Taskforce Report (revised from 1994). Retrieved from http://www.igbconline.org/index.php/historical-documents; http://www.igbconline.org/index.php/who-we-are/about-the-igbc

ILBT. (2013). Canada Lynx Conservation Assessment and Strategy, 3rd Edition. Retrieved from http://www.fs.fed.us/biology/resources/pubs/wildlife/index.html

Inman, R. M., Brock, B. L., Inman, K. H., Sartorius, S. S., Aber, B. C., Giddings, B., . . . Chapron, G. (2013). Developing priorities for metapopulation conservation at the landscape scale: Wolverines in the Western United States. Biological Conservation, 166, 276-286. doi:10.1016/j.biocon.2013.07.010

Inman, R. M., Magoun, A. J., Persson, J., & Mattisson, J. (2012). The wolverine's niche: linking reproductive chronology, caching, competition, and climate. Journal of Mammology, 93(3), 634-644. doi:http://dx.doi.org/10.1644/11-MAMM-A-319.1

Inman, R. M., Magoun, A. J., Persson, J., Pedersen, D., Mattisson, J., & Bell, J. K. (2007). Chapter 3: Wolverine reproductive chronology in Greater Yellowstone Wolverine Study. Retrieved from Ennis, MT, USA: http://www.wcsnorthamerica.org/AboutUs/Publications/tabid/3437/Default.aspx

Inman, R. M., Packila, M. L., Inman, K. H., Aber, B., Spence, R., & McCauley, D. (2009). Greater Yellowstone Wolverine Program. Retrieved from Ennis, MT, USA: http://www.wcsnorthamerica.org/AboutUs/Publications/tabid/3437/Default.aspx; http://www.wcsnorthamerica.org/About-Us/Publications.aspx

IPCC. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

IPCC. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

IPCC. (2007). Summary for Policymakers. Retrieved from Cambridge, UK: https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf

Isaak, D. J., Luce, C. H., Rieman, B. E., Nagel, D. E., Peterson, E. E., Horan, D. L., . . . Chandler, G. L. (2010). Effects of climate change and wildfire on stream temperatures and salmonid thermal habitat in a mountain river network. Ecological Applications, 20(5), 1350-1371. doi:10.1890/09-0822.1

Isaak, D. J., Young, M. K., Nagel, D. E., Horan, D. L., & Groce, M. C. (2015). The cold-water climate shield: delineating refugia for preserving salmonid fishes through the 21st century. Global Change Biology, 21(7), 2540-2553. doi:10.1111/gcb.12879

ISAB. (2007). Climate Change Impacts on Columbia River Basin Fish and Wildlife. Retrieved from Portland, OR: https://www.nwcouncil.org/media/31247/isab2007_2.pdf

Jackson, E. L., & Wong, R. A. G. (1982). Perceived conflict between urban cross-country skiers and snowmobilers in Alberta. Journal of Leisure Research, 14(1), 47-62.

Jacobs, J. (2007). Chapter 8. Invasive Plant Management: Options and Actions Invasive Plant Management: CIPM Online Textbook. Bozeman, Montana: Natural Resources Conservation Service.

Jacobs, J., & Sing, S. (2007). Ecology and Management of Houndstongue (Cynoglossum officinale L.). Retrieved from Bozeman, MT: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_050222.pdf

Jiménez Esquilín, A. E., Stromberger, M. E., & Shepperd, W. D. (2008). Soil Scarification and Wildfire Interactions and Effects on Microbial Communities and Carbon. Soil Science Society of America Journal, 72, 111-118. doi:10.2136/sssaj2006.0292

Jimenez, M. (2014). Report to Regional Director, Region 6, Denver, CO. Service Review of the 2013 wolf population in the NRM DPS. Retrieved from

Johnson, D. (1990). Indian tribes of the Northern Region: A brief history. Retrieved from Missoula, MT:

Johnson, D. W., & Curtis, P. S. (2001). Effects of forest management on soil C and N storage: meta analysis. Forest Ecology and Management, 140(2-3), 227-238. doi:10.1016/S0378-1127(00)00282-6

Johnson, P. T. J., Lunde, K. B., Thurman, E. M., Ritchie, E. G., Wray, S. N., Sutherland, D. R., . . . Blaustein, A. R. (2002). Parasite (Ribeiroia ondatrae) infection linked to amphibian malformations in the western United States. Ecological Monographs, 72(2), 151-168. doi:10.1890/0012-9615(2002)072[0151:Proilt]2.0.Co;2

Jones, J. A., & Grant, G. E. (1996). Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon. Water Resources Research, 32(4), 959-974. doi:10.1029/95wr03493

Jones, J. L. (1991). Habitat use of fisher in north-central Idaho. (Masters of Science), University of Idaho, Moscow, ID.

Jones, J. L., & Garton, E. O. (1994). Selection of successional stages by fisher in north central Idaho. In S. W. Buskirk, A. Harestad, M. Raphael, & R. A. Powell (Eds.), Martens, sables, and fishers: biology and conservation, pages 377-387 (pp. 484). Ithaca, NY: Cornell University Press.

Jones, T., & Cresswell, W. (2010). The phenology mismatch hypothesis: are declines of migrant birds linked to uneven global climate change? Journal of Animal Ecology, 79(1), 98-108. doi:10.1111/j.1365-2656.2009.01610.x

Jonkel, C. J., & Cowan, I. M. (1971). The black bear in the spruce-fir forest. Wildlife Monographs, 27, 3-57.

Joyce, L. A., Blate, G. M., Littell, J. S., McNulty, S. G., Millar, C. I., Moser, S. C., . . . Peterson, D. L. (2008). National Forests. In S. H. Julius, J. M. West, J. S. Baron, B. Griffith, L. A. Joyce, P. Kareiva, B. D. Keller, M. A. Palmer, C. H. Peterson, & J. M. Scott (Eds.), Preliminary review of adaptation options for climate-sensitive ecosystems and resources. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (pp. 3-1 to 3-127). Washington, D.C.: U.S. Environmental Protection Agency.

Karr, J. R., & Chu, E. W. (1999). Restoring Life in Running Waters: Better Biological Monitoring, Revised edition Washington, D.C.: Island Press.

Kashian, D. M., Romme, W. H., Tinker, D. B., Turner, M. G., & Ryan, M. G. (2006). Carbon storage on landscapes with stand-replacing fires. Bioscience, 56(7), 598-606. doi:10.1641/0006-3568(2006)56[598:Csolws]2.0.Co;2

Katherine H. Anderson and Robert S. Thompson. Historic Variations in Moisture Availability. U.S. Department of the Interior, U.S. Geological Survey. URL:

http://geochange.er.usgs.gov/sw/changes/natural/pdsi/ Includes link to Palmer Drought Severity Index.

Katherine H. Anderson and Robert S. Thompson. Historic Variations in Moisture Availability. U.S. Department of the Interior, U.S. Geological Survey. URL: http://geochange.er.usgs.gov/sw/changes/natural/pdsi/ Includes link to Palmer Drought Severity Index.

Kauffman, J. B. (1990). Ecological relationships of vegetation and fire in Pacific Northwest forests, pages 39-52 In J. D. Walstad, S. R. Radosevich, & D. V. Sandberg (Eds.), Natural and prescribed fire in Pacific Northwest forests. Corvallis, OR: Oregon State University Press.

Kauffman, J. B., & Krueger, W. C. (1984). Livestock Impacts on Riparian Ecosystems and Streamside Management Implications - a Review. Journal of Range Management, 37(5), 430-438. doi:10.2307/3899631

Kaushal, S. S., Likens, G. E., Jaworski, N. A., Pace, M. L., Sides, A. M., Seekell, D., . . . Wingate, R. L. (2010). Rising stream and river temperatures in the United States. Frontiers in Ecology and the Environment, 8(9), 461-466. doi:10.1890/090037

Keane, R. E. (1999). Whitebark pine: A declining high mountain tree species. Sage Notes [Idaho Native Plant Society], 21(2), 6-9.

Keane, R. E. (2000). The Importance of Wilderness to Whitebark Pine Research and Management. In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer. Wilderness science in a time of change conference, Volume 3: Wilderness as a place for scientific inquiry; 1999 May 23–27; Missoula, MT. Retrieved from Ogden, UT: http://www.fs.fed.us/rm/pubs/rmrs_p015_3.pdf

Keane, R. E., & Arno, S. F. (1993). Rapid Decline of Whitebark Pine in Western Montana: Evidence from 20-Year Remeasurements. Western Journal of Applied Forestry, 8(2), 44-47.

Keane, R. E., & Morgan, P. (1994). Decline of Whitebark pine in the Bob Marshall Wilderness Cpmplex of Montana, U.S.A., pages 245-253. In: Proceedings - International Workshop on Subalpine Stone Pines and their Environment: the Status of our Knowledge; St. Morita, Switzerland, September 5-11, 1992; INT-GTR-309: . Retrieved from Ogden, UT:

Keane, R. E., & Parsons, R. A. (2010). Restoring Whitebark Pine Forests of the Northern Rocky Mountains, USA. Ecological Restoration Vol. 28, No. 1, 2010, 28(1), 56-70.

Keane, R. E., Bollenbacher, B., Manning, M., Loehman, R., Jain, T., Holsinger, L., . . . Webster, M. (2015). Chapter 6: Forest Vegetation. In: Draft Climate Change Vulnerability and Adaptation in the Northern Rocky Mountains. Retrieved from

Keane, R. E., Morgan, P., & Menakis, J. P. (1994). Landscape Assessment of the Decline of Whitebark pine (Pinus albicaulis) in the Bob Marshall Wilderness Complex, Montana, USA. Northwest Science, 68(3), 213-229.

Keane, R. E., Tomback, D. F., Aubry, C. A., Bower, A. D., Campbell, E. M., Cripps, C. L., . . . Smith, C. M. (2012). A range-wide restoration strategy for whitebark pine (Pinus albicaulis). Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/40884; http://www.fs.fed.us/rm/pubs/rmrs_gtr279.pdf

Keane, R. E., Tomback, D. F., Davy, L., Jenkins, M., & Applegate, V. (2013). Climate Change and Whitebark Pine: Compelling reasons for restoration. Retrieved from http://whitebarkfound.org/wp-content/uploads/2013/11/WPEF_wbp_climatechangev4.pdf

Keane, R.E.; Mahalovich, M.F.; Bollenbacher, B. [et al.]. Effects of climatic variability and change on forest vegetation. In Halofsky, J.E.; Peterson, D.L.; Hoang, L., eds. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. In press.

Keane, R.E.; Mahalovich, M.F.; Bollenbacher, B. [et al.]. Effects of climatic variability and change on forest vegetation. In Halofsky, J.E.; Peterson, D.L.; Hoang, L., eds. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. In press.

Keane, Robert E.; Tomback, D.F.; Aubry, C.A.; Bower, A.D.; Campbell, E.M.; Cripps, C.L.; Jenkins, M.B.; Mahalovich, M.F.; Manning, M.; McKinney, S.T.; Murray, M.P.; Perkins, D.L.; Reinhart, D.P.; Ryan, C.; Schoettle, A.W.; Smith, C.M. 2012. A range-wide restoration strategy for whitebark pine (Pinus albicaulis). Gen. Tech. Rep. RMRS-GTR-279. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 108 p.

Keane, Robert E.; Tomback, D.F.; Aubry, C.A.; Bower, A.D.; Campbell, E.M.; Cripps, C.L.; Jenkins, M.B.; Mahalovich, M.F.; Manning, M.; McKinney, S.T.; Murray, M.P.; Perkins, D.L.; Reinhart, D.P.; Ryan, C.; Schoettle, A.W.; Smith, C.M. 2012. A range-wide restoration strategy for whitebark pine (Pinus albicaulis). Gen. Tech. Rep. RMRS-GTR-279. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 108 p.

Keeley, J. E. (2006). Fire management impacts on invasive plants in the western United States. Conservation Biology, 20(2), 375-384. doi:10.1111/J.1523-1739.2006.00339.X

Keeley, J. E., & McGinnis, T. W. (2007). Impact of prescribed fire and other factors on cheatgrass persistence in a Sierra Nevada ponderosa pine forest. International Journal of Wildland Fire, 16(1), 96-106. doi:http://dx.doi.org/10.1071/WF06052

Kellert, S. R., Black, M., Rush, C. R., & Bath, A. J. (1996). Human culture and large carnivore conservation in North America. Conservation Biology, 10(4), 977-990. doi:10.1046/j.1523-1739.1996.10040977.x

Kelly, L. M. (1992). The effects of human disturbance on common loon productivity in northwestern Montana. (Master of Science), Montana State University, Bozeman, MT. Retrieved from http://scholarworks.montana.edu/xmlui/bitstream/1/7174/1/31762101921714.pdf

Kendall, C. N. (2013). Range Program Assessment, Flathead National Forest, December 2013 (Draft). Retrieved from Kalispell, MT: No URL for this draft report.

Kendall, C. N. (2014). Index Scores of Stream Habitat in Reference and Managed Catchments, Flathead National Forest. Retrieved from Kalispell, MT: No URL link

Kendall, K. C., & Arno, S. F. (1990). Whitebark pine: an important but endangered wildlife resource. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/42418; http://www.fs.fed.us/rm/pubs_int/int_gtr270.pdf

Kendall, K. C., & Keane, R. E. (2001). Whitebark pine decline: Infection, mortality, and population trends. In D. F. Tomback, S. F. Arno, & R. E. Keane (Eds.), Whitebark pine communities: ecology and restoration (pp. 221-242). Washington, D.C.: Island Press.

Kendall, K. C., Stetz, J. B., Boulanger, J., Macleod, A. C., Paetkau, D., & White, G. C. (2009). Demography and genetic structure of a recovering grizzly bear population. Journal of Wildlife Management, 73(1), 3-17. doi:10.2193/2008-330

Kendall, K. C., Stetz, J. B., Roon, D. A., Waits, L. P., Boulanger, J. B., & Paetkau, D. (2008). Grizzly bear density in Glacier National Park, Montana. Journal of Wildlife Management, 72(8), 1693-1705. doi:10.2193/2008-007

Kershner, J. L., Archer, E. K., Coles-Ritchie, M., Cowley, E. R., Henderson, R. C., Kratz, K., . . . Vinson, M. R. (2004). Guide to effective monitoring of aquatic and riparian resources. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/6259; http://www.fs.fed.us/rm/pubs/rmrs_gtr121.pdf

Kershner, J. L., Archer, E. K., Coles-Ritchie, M., Cowley, E. R., Henderson, R. C., Kratz, K., . . . Vinson, M. R. (2004). Guide to effective monitoring of aquatic and riparian resources. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/6259; http://www.fs.fed.us/rm/pubs/rmrs_gtr121.pdf

Kirchner, J. W., Finkel, R. C., Riebe, C. S., Granger, D. E., Clayton, J. L., King, J. G., & Megahan, W. F. (2001). Mountain erosion over 10 yr, 10 k.y., and 10 m.y. time scales. Geology, 29(7), 591-594. doi:10.1130/0091-7613(2001)029<0591:Meoyky>2.0.Co;2

Knight, R. R., Blanchard, B. M., & Eberhardt, L. L. (1988). Mortality Patterns and Population Sinks for Yellowstone Grizzly Bears, 1973-1985. Wildlife Society Bulletin, 16(2), 121-125.

Knight, R. R., Blanchard, B. M., & Mattson, D. J. (1988). Yellowstone grizzly bear investigations: annual report of the Interagency Study Team, 1987. Retrieved from Bozeman, MT: http://www.nrmsc.usgs.gov/products/IGBST

Koehler, G. M., & Hornocker, M. G. (1977). Fire Effects on Marten Habitat in Selway-Bitterroot Wilderness. Journal of Wildlife Management, 41(3), 500-505. doi:10.2307/3800522

Koehler, G. M., Hornocker, M. G., & Hash, H. S. (1979). Lynx movements and habitat use in Montana. Canadian Field Naturalist, 93(4), 441-442.

Kosterman, M. K. (2014). Correlates of Canada Lynx Reproductive Success in Northwestern Montana, Paper 4363. (Master of Science), Wildlife Biology, University of Montana, Missoula, MT. Retrieved from http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=5406&context=etd

Kotliar, N. B. (2007). Olive-sided Flycatcher (Contopus cooperi): a technical conservation assessment. Retrieved from Fort Collins, CO: http://www.fs.fed.us/r2/projects/scp/assessments/olivesidedflycatcher.pdf http://www.fs.usda.gov/detail/r2/landmanagement/?cid=stelprdb5201278 http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182039.pdf

Kotliar, N. B., Kennedy, P. L., & Ferree, K. (2007). Avifaunal responses to fire in southwestern montane forests along a burn severity gradient. Ecological Applications, 17(2), 491-507. doi:10.1890/06-0253

Kovach, R. P., Muhlfeld, C. C., Boyer, M. C., Lowe, W. H., Allendorf, F. W., & Luikart, G. (2015). Dispersal and selection mediate hybridization between a native and invasive species. Proceedings of the Royal Society of London B: Biological Sciences, 282(1799). doi:10.1098/rspb.2014.2454

Kuchel, C. R. (1977). Some aspects of the behavior and ecology of harlequin ducks breeding in Glacier National Park, Montana. (Master of Science), University of Montana, School of Forestry, Wildlife Biology Program, Montana, MT.

Kujala, Q. (2011). Montana Mountain Lion Status Report. In J. Williams, H. Robinson, & L. Sweanor (Eds.), Proceedings of the 10th Mountain Lion Workshop, Cougars: Conservation, Connectivity and Population Management, May 2-5, 2011 (pp. 14). Bozeman, MT.

Kuras, P. K., Alila, Y., & Weiler, M. (2012). Forest harvesting effects on the magnitude and frequency of peak flows can increase with return period. Water Resources Research, 48. doi:10.1029/2011wr010705

Kurz, W. A., Dymond, C. C., Stinson, G., Rampley, G. J., Neilson, E. T., Carroll, A. L., . . . Safranyik, L. (2008). Mountain pine beetle and forest carbon feedback to climate change. Nature, 452, 987-990. doi:10.1038/nature06777

Kurz, W. A., Stinson, G., & Rampley, G. J. (2008). Could increased boreal forest ecosystem productivity offset carbon losses from increased disturbances? Philosophical Transactions of the Royal Society B-Biological Sciences, 363(1501), 2261-2269. doi:10.1098/rstb.2007.2198

Kurz, W. A., Stinson, G., Rampley, G. J., Dymond, C. C., & Neilson, E. T. (2008). Risk of natural disturbances makes future contribution of Canada's forests to the global carbon cycle highly uncertain. Proceedings of the National Academy of Sciences of the United States of America, 105(5), 1551-1555. doi:10.1073/pnas.0708133105

Lackey, R. T. (2001). Values, policy, and ecosystem health. Bioscience, 51(6), 437-443. doi:10.1641/0006-3568(2001)051[0437:Vpaeh]2.0.Co;2

Lake, P. S. (2000). Disturbance, patchiness, and diversity in streams. Journal of the North American Benthological Society, 19(4), 573-592. doi:10.2307/1468118

Latif, Q. S., Saab, V. A., Dudley, J. G., & Hollenbeck, J. P. (2013). Ensemble modeling to predict habitat suitability for a large-scale disturbance specialist. Ecology and Evolution, 3(13), 4348-4364. doi:10.1002/ece3.790

Laudenslayer, W. F., Jr., Shea, P. J., Valentine, B. E., Weatherspoon, C. P., & Lisle, T. E. (2002). Proceedings of the symposium on the ecology and management of dead wood in western forests. 1999 November 2-4; Reno, NV. Retrieved from Albany, CA: http://www.treesearch.fs.fed.us/pubs/6718 http://www.fs.fed.us/psw/publications/documents/psw_gtr181/psw_gtr181.pdf

Lawler, J. J., Safford, H. D., & Girvetz, E. H. (2012). Martens and fishers in a changing climate. In K. B. Aubry, W. J. Zielinski, M. G. Raphael, G. Proulx, & S. W. Buskirk (Eds.), Biology and conservation of martens, sables, and fishers: a new synthesis (pp. 580). Ithaca, NY: Cornell University Press.

Laymon, S. A., & Halterman, M. D. (1987). Can the Western Subspecies of the Yellow-billed Cuckoo be Saved from Extinction? Western Birds, 19-26.

Leathe, S. A., & Enk, M. D. (1985). Cumulative Effects of Micro-hydro Development on the Fisheries of the Swan River Drainage, Montana, Volume I, Project No. 1982-01900. Retrieved from Kalispell, MT: https://pisces.bpa.gov/release/documents/documentviewer.aspx?doc=36717-1

Lee, D. C., Sedell, J. R., Rieman, B. F., Thurow, R. F., & Williams, J. E. (1997). Broadscale assessment of aquatic species and habitats, Chapter 4. In T. M. Quigley & S. J. Arbelbide (Eds.), An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins, Vol. 1. General Technical Report PNW-405 (pp. 1058-1496). Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

LeFranc Jr., M. N., Moss, M. B., Patnode, K. A., & Sugg III, W. C. (1987). Grizzly bear compendium, Interagency Grizzly Bear Committee. Retrieved from The National Wildlife Federation, Washington, D. C.: No URL found

Lenihan, J. M., Bachelet, D., Neilson, R. P., & Drapek, R. (2008). Response of vegetation distribution, ecosystem productivity, and fire to climate change scenarios for California. Climatic Change, 87, S215-S230. doi:10.1007/s10584-007-9362-0

Lesica, P. (1990). Habitat requirements, germination behavior and seed bank dynamics of Howellia aquatilis in the Swan Valley, Montana. Retrieved from

Lesica, P. (1997). Spread of Phalaris arundinacea adversely impacts the endangered plant Howellia aquatilis. Great Basin Naturalist, 57(4), 366-368.

Lesica, P. (1999). Effects of fire on the demography of the endangered, geophytic herb Silene spaldingii (Caryophyllaceae). American Journal of Botany, 86(7), 996-1002. doi:10.2307/2656617

Levad, R. G., Potter, K. M., Shultz, C. W., Gunn, C., & Doerr, J. G. (2008). Distribution, abundance, and nest-site characteristics of Black Swifts in the Southern Rocky Mountains of Colorado and New Mexico. Wilson Journal of Ornithology, 120(2), 331-338. doi:http://dx.doi.org/10.1676/07-049.1

Lichthardt, J. (1997). Revised report on the conservation status of Silene spaldingii in Idaho. Retrieved from Boise, ID:

Liknes, G. A., & Graham, P. J. (1988). Westslope cutthroat trout in Montana: life history, status, and management. American Fisheries Society Symposium, 4, 53-60.

Linnell, J. D. C., Swenson, J. E., Andersen, R., & Barnes, B. (2000). How Vulnerable are Denning Bears to Disturbance? Wildlife Society Bulletin, 28(2), 400-413.

Littell, J. S., McKenzie, D., Peterson, D. L., & Westerling, A. L. (2009). Climate and wildfire area burned in western U. S. ecoprovinces, 1916-2003. Ecological Applications, 19(4), 1003-1021. doi:10.1890/07-1183.1

Littell, J.S., D. McKenzie, D.L. Peterson, and A.L. Westerling. 2009. Climate and wildfire area burned in western U.S. ecoprovinces, 1916-2003. Ecological Applications 19: 1003-1021.

Littell, J.S., D. McKenzie, D.L. Peterson, and A.L. Westerling. 2009. Climate and wildfire area burned in western U.S. ecoprovinces, 1916-2003. Ecological Applications 19: 1003-1021.

Lizon, P. (2011). Big Creek Sediment TMDL Implementation Evaluation. Retrieved from Helena, MT: https://deq.mt.gov/Portals/112/Water/WQPB/TMDL/BigCreekTMDLImplementation_Evaluation2011.pdf

Loehman, Rachel A., Bentz……. NRAP chapter 8. In Halofsky, J.E.; Peterson, D.L.; Hoang, L., eds. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. In press.

Loehman, Rachel A., Bentz……. NRAP chapter 8. In Halofsky, J.E.; Peterson, D.L.; Hoang, L., eds. Climate change vulnerability and adaptation in the Northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-xxx. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. In press.

Lofroth, E. C., Raley, C. M., Higley, J. M., Truex, R. L., Yaeger, J. S., Lewis, J. C., . . . Brown, R. N. (2010). Conservation of fishers (Martes pennanti) in south-central British Columbia, western Washington, western Oregon, and California, Volume 1. In E. C. Lofroth, C. M. Raley, L. L. Finley, & R. H. Naney (Eds.), Conservation Assessment. Denver, CO: U.S. Department of the Interior, Bureau of Land Management.

Lohr, S. C., & Fausch, K. D. (1997). Multiscale Analysis of Natural Variability in Stream Fish Assemblages of a Western Great Plains Watershed. Copeia, 1997(4), 706-724. doi:10.2307/1447289

Lorenz, A. W., & Feld, C. K. (2013). Upstream river morphology and riparian land use overrule local restoration effects on ecological status assessment. Hydrobiologia, 704(1), 489-501. doi:10.1007/s10750-012-1326-3

Lorenz, T. J., Aubry, C., & Shoal, R. (2008). A review of the literature on seed fate in whitebark pine and the life history traits of Clark's nutcracker and pine squirrels. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/29647; http://www.fs.fed.us/pnw/pubs/pnw_gtr742.pdf

Lowe, S. J., Patterson, B. R., & Schaefer, J. A. (2010). Lack of behavioral responses of moose (Alces alces) to high ambient temperatures near the southern periphery of their range. Canadian Journal of Zoology, 88(10), 1032-1041. doi:10.1139/Z10-071

Luce, C. H., & Black, T. A. (1999). Sediment production from forest roads in western Oregon. Water Resources Research, 35(8), 2561-2570. doi:10.1029/1999wr900135

Luce, C. H., & Holden, Z. A. (2009). Declining annual streamflow distributions in the Pacific Northwest United States, 1948–2006. Geophysical Research Letters, 36(16), L16401. doi:10.1029/2009GL039407

Luce, C. H., & Rieman, B. E. (2010). Chapter 12: Landscape scale effects of fuel management or fire on water resources: The future of cumulative effects analysis? In W. J. Elliot, I. S. Miller, & L. Audin (Eds.), Cumulative watershed effects of fuel management in the western United States. General Technical Report RMRS-231 (pp. 234-245). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Luce, C. H., Rieman, B. E., Dunham, J. B., Clayton, J. L., King, J. G., & Black, T. A. (2001). Incorporating aquatic ecology into decisions on prioritization of road decommissioning. Water Resources Impact, 3(3), 8-14.

Lyon, L. J., Huff, M. H., & Smith, J. K. (2000). Chapter 6: Fire Effects on Fauna at Landscape Scales, p 43-50. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/4553; http://www.fs.fed.us/rm/pubs/rmrs_gtr042_1.pdf

Lyon, L. J., Huff, M. H., & Smith, J. K. (2000). Chapter 6: Fire Effects on Fauna at Landscape Scales, p 43-50. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/4553; http://www.fs.fed.us/rm/pubs/rmrs_gtr042_1.pdf

Lyon, L. J., Huff, M. H., & Smith, J. K. (2000). Chapter 6: Fire Effects on Fauna at Landscape Scales, p 43-50. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/4553; http://www.fs.fed.us/rm/pubs/rmrs_gtr042_1.pdf

Lyon, L. Jack; Huff, Mark H.; Jand Kapler. 2000. Chapter 6: Fire effects on fauna at landscape scales. In: Smith, Jane Kapler, ed. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42-vol. 1. Ogden, UT: USDA, Forest Service, Rocky Mtn. Res. Sta.: 43-49.

Lyon, L. Jack; Huff, Mark H.; Jand Kapler. 2000. Chapter 6: Fire effects on fauna at landscape scales. In: Smith, Jane Kapler, ed. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42-vol. 1. Ogden, UT: USDA, Forest Service, Rocky Mtn. Res. Sta.: 43-49.

MacDonald, L. H., & Stednick, J. D. (2003). Forests and Water: A State-of-the-Art Review for Colorado. Retrieved from Fort Collins, CO: http://www.fs.fed.us/rm/pubs_exp_forests/manitou/rmrs_2003_macDonald_l001.pdf

MacDonald, L. H., Wohl, E. E., & Madsen, S. W. (1997). Validation of water yield thresholds on the Kootenai National Forest. Retrieved from Fort Collins, CO: http://warnercnr.colostate.edu/~leemac/publications/WaterYield_KootenaiNF.PDF; http://warnercnr.colostate.edu/~leemac/publications_categ.htm

Mace, R. D., & Jonkel, C. J. (1986). Local food habits of the grizzly bear in Montana. Ursus, 6, 105-110.

Mace, R. D., & Manley, T. L. (1993). South Fork Flathead River Grizzly Bear Project: Progress Report for 1992. Retrieved from Helena, MT: No URL found

Mace, R. D., & Roberts, L. L. (2011). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2009-2010. Retrieved from Kalispell, MT: http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

Mace, R. D., & Roberts, L. L. (2012). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2011. Retrieved from Kalispell, MT: http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

Mace, R. D., & Roberts, L. L. (2013). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2012. Retrieved from Kalispell, MT: http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

Mace, R. D., & Roberts, L. L. (2014). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2013. Retrieved from Kalispell, MT: http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

Mace, R. D., & Roberts, L. L. (2015). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2014. Retrieved from Kalispell, MT: http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

Mace, R. D., & Waller, J. S. (1996). Grizzly bear distribution and human conflicts in Jewel Basin Hiking Area, Swan Mountains, Montana. Wildlife Society Bulletin, 24(3), 461-467.

Mace, R. D., & Waller, J. S. (1997). Final report: Grizzly bear ecology in the Swan Mountains, Montana. Retrieved from Helena, MT: http://fwp.mt.gov/fwpDoc.html?id=52073; http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

Mace, R. D., Waller, J. S., Manley, T. L., Ake, K., & Wittinger, W. T. (1999). Landscape evaluation of grizzly bear habitat in western Montana. Conservation Biology, 13(2), 367-377. doi:10.1046/j.1523-1739.1999.013002367.x

Mace, R. D., Waller, J. S., Manley, T. L., Lyon, L. J., & Zuuring, H. (1996). Relationships among grizzly bears, roads and habitat in the Swan Mountains, Montana. Journal of Applied Ecology, 33(6), 1395-1404. doi:10.2307/2404779

Mackie, R. J., Pac, D. F., Hamlin, K. L., & Dusek, G. L. (1998). Ecology and management of mule deer and white-tailed deer in Montana. Retrieved from Helena, MT: http://fwp.mt.gov/fwpDoc.html?id=50732

Mahalovich, M. F., and V. D. Hipkins (2011). Molecular genetic variation in whitebark pine (Pinus albicaulis Engelm.) in the Inland West. In: Keane, R. E., D. F. Tomback, M. P. Murray and C. M. Smith, eds. (2011). The future of high-elevation, five-needle white pines in Western North America: Proceedings of the High Five Symposium. 28-30 June 2010; Missoula, MT. Proceedings RMRS-P-63. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 376.

Mahalovich, M. F., and V. D. Hipkins (2011). Molecular genetic variation in whitebark pine (Pinus albicaulis Engelm.) in the Inland West. In: Keane, R. E., D. F. Tomback, M. P. Murray and C. M. Smith, eds. (2011). The future of high-elevation, five-needle white pines in Western North America: Proceedings of the High Five Symposium. 28-30 June 2010; Missoula, MT. Proceedings RMRS-P-63. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 376.

Mahr, M., & Jones, K. (2005). Bird Biodiversity in the Flathead River Basin: A Conservation Hotspot in the Yellowstone to Yukon Corridor. Report prepared for the Flathead Lakers and Flathead Chapter of The Audubon Society. Yellowstone to Yukon Conservation Initiative. Retrieved from Canmore, Alberta, Canada: http://y2y.net/publications/copy_of_technical-reports; http://y2y.net/publications/technical-reports/505mahrbirdbiodiversityintheflatheadriverbasin.pdf

Malcolm, K. (2013). Beaver Restoration Toolbox. A collection of insights, resources, and expert contacts to guide riparian restoration projects that capitalize on the engineering capacity of the North American beaver. Retrieved from http://www.martinezbeavers.org/wordpress/wp-content/uploads/2013/10/Beaver-Restoration-Toolbox-Karl-Malcolm-2013.pdf

Mann, J. (2013, Wednesday, November 13, 2013). Article about elk in The Daily InterLake on Wednesday, November 13, 2013,. Retrieved from No URL

Marin, M. (1997). Some aspects of the breeding biology of the Black swift. Wilson Bulletin, 109(2), 290-306.

Marks, J., & Casey, D. (2005). Monitoring Black Swifts in Montana: 2004 Annual Report. Retrieved from Helena, MT: http://archive.org/stream/60AD4B1E-A917-4BBC-BA59-887AAA9C3B7E/60AD4B1E-A917-4BBC-BA59-887AAA9C3B7E_djvu.txt

Martin, P. A. E. (1979). Productivity and taxonomy of the Vaccinium globulare, V. membranaceum complex in western Montana. (Master of Science), University of Montana, Missoula, MT. Retrieved from No URL found Available from http://worldcat.org

Martinez, P. J., Bigelow, P. E., Deleray, M. A., Fredenberg, W. A., Hansen, B. S., Horner, N. J., . . . Viola, A. E. (2009). Western lake trout woes. Fisheries, 34(9), 424-442. doi:10.1577/1548-8446-34.9.424

Martinka, C. J., & Kendall, K. C. (1986). Grizzly bear habitat research in Glacier National Park, Montana. Retrieved from Ogden, UT: https://www.fort.usgs.gov/sites/default/files/products/publications/286/286.pdf

Martinson, A. H., & Basko, W. J. (1983). Flathead County, Land System Inventory: a soil resource inventory and analysis for land-use planning and resource allocation. Retrieved from Kalispell, MT: No URL found

Matchett, M. R. (1985). Habitat selection by moose in the Yaak River drainage, northwestern Montana. Alces, 21, 161-189.

Matchett, M. R. (1985). Moose-habitat relationships in the Yaak River drainage, northwestern Montana. (Master of Science), University of Montana, Missoula, MT.

Mattson, D. J., & Reinhart, D. P. (1994). Bear use of whitebark pine seeds in North America. In Proceedings International workshop on subalpine stone pines and their environment: The status of our knowledge. Retrieved from Ogden, UT:

Mattson, D. J., Blanchard, B. M., & Knight, R. R. (1991). Food-habits of Yellowstone grizzly bears, 1977-1987. Canadian Journal of Zoology, 69(6), 1619-1629. doi:10.1139/Z91-226

Mattson, D. J., Kendall, K. C., & Reinhart, D. P. (2001). Whitebark pine, grizzly bears, and red squirrels Whitebark pine communities: ecology and restoration (pp. 121-136). Washington, D.C.: Island Press.

Mattson, D. J., Knight, R. R., & Blanchard, B. M. (1987). The Effects of Developments and Primary Roads on Grizzly Bear Habitat Use in Yellowstone National Park, Wyoming. International Association for Bear Research and Management, 7, 259-273. doi:10.2307/3872633

Maxell, B. A. (2000). Management of Montana's amphibians: a review of factors that may present a risk to population viability and accounts on the identification, distribution, taxonomy, habitat use, natural history, and the status and conservation of individual species. Retrieved from Missoula, MT: http://www.isu.edu/~petechar/iparc/Maxell_Mgmnt.pdf

Maxell, B. A. (2015). Montana's Bats: Distribution, Conservation Status, and Roost Site Overview. Retrieved from http://mtnhp.org

Maxell, B. A., Hokit, G., Miller, J., & Werner, K. (2004). Detection of (Batrachochytrium dendrobatidis), the Chytrid fungus associated with global amphibian declines, in Montana amphibians. Retrieved from Helena, MT: http://mtnhp.org/animal/presentations/021904_chytrid_fungus.pdf

Maxell, B. A., Nelson, K. J., & Browder, S. (2002). Record Clutch Size and Observations on Breeding and Development of the Western Toad (Bufo boreas) in Montana. Northwestern Naturalist, 83(1), 27-30. doi:10.2307/3536513

MBDC. (2012). P. D. Skaar's Montana Bird Distribution, Seventh Edition. Helena, MT: Updated and revised by the Montana Bird Distribution Committee (MBDC).

MBEWG. (2010). Montana Bald Eagle Management Guidelines: an addendum to Montana Bald Eagle Management Plan, 1994. Retrieved from Helena, MT: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB4QFjAA&url=http%3A%2F%2Ffwp.mt.gov%2FfwpDoc.html%3Fid%3D44181&ei=IiCGVP6xDMPvoATX3oDYAQ&usg=AFQjCNHwrFUlJtBGJYlhUdV9Yy8mRF8A5g

MBTSG. (1995). Flathead River drainage bull trout status report (including Flathead Lake, the North and Middle Forks of the Flathead river, and the Stillwater and Whitefish Rivers). Retrieved from Helena, MT: No URL found

MBTSG. (1995). South Fork Flathead River drainage bull trout status report (upstream of Hungry Horse Dam). Retrieved from Helena, MT: No URL found

McCallum, D. A. (1994). Chapter 4: Review of technical knowledge: Flammulated owls. In G. D. Hayward & J. Verner (Eds.), Flammulated, boreal, and great gray owls in the United States: a technical conservation assessment. General Technical Report RM-253 (pp. 214). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

McCaughey, W. W., & Tomback, D. F. (2001). The natural regeneration process. In D. F. Tomback, S. F. Arno, & R. E. Keane (Eds.), Whitebark pine communities: ecology and restoration (pp. 105-120). Washington D.C.: Island Press.

McClelland, B. R. (1977). Relationships between hole-nesting birds, forest snags, and decay in western larch-Douglas-fir forests of the northern Rocky Mountains. (Ph.D. dissertation), University of Montana, Missoula, MT.

McClelland, B. R., & McClelland, P. T. (1999). Pileated Woodpecker Nest and Roost Trees in Montana: Links with Old-Growth and Forest "Health". Wildlife Society Bulletin, 27(3), 846-857.

McCool, S. F., Cole, D. N., Borrie, W. T., & O'Loughlin, J. (2000). Wilderness science in a time of change conference, Volume 3: Wilderness as a place for scientific inquiry; 1999 May 23–27; Missoula, MT. Retrieved from Ogden, UT: http://www.fs.fed.us/rm/pubs/rmrs_p015_3.pdf

McIntyre, J. D. (1998). An assessment of bull trout and lake trout interactions in Flathead Lake, Montana. Retrieved from Helena, MT: No URL found

McIver, J. D., & Starr, L. (2000). Environmental effects of postfire logging: literature review and annotated bibliography. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/2955; http://www.fs.fed.us/pnw/pubs/pnw_gtr486.pdf

McKelvey, K. S., Aubry, K. B., & Ortega, Y. K. (1999). Chapter 8: History and distribution of lynx in the contiguous United States. In L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, & J. R. Squires (Eds.), Ecology and conservation of lynx in the United States, General Technical Report RMRS-30WWW (pp. 480). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

McKelvey, K. S., Copeland, J. P., Schwartz, M. K., Littell, J. S., Aubry, K. B., Squires, J. R., . . . Mauger, G. S. (2011). Climate change predicted to shift wolverine distributions, connectivity, and dispersal corridors. Ecological Applications, 21(8), 2882-2897. doi:10.1890/10-2206.1

McKelvey, K. S., Young, M. K., Wilcox, T. M., Bingham, D. M., Pilgrim, K. L., & Schwartz, M. K. (2016). Patterns of hybridization among cutthroat trout and rainbow trout in northern Rocky Mountain streams. Ecology and Evolution, 6(3), 688-706. doi:10.1002/ece3.1887

McKenna, M. F., Lignell, B., Rapoza, A., Lee, C., Ward, V., & Rocchio, J. (2015). A framework to assess the effects of commercial air tour noise on wilderness. Journal of Forestry, Society of American Foresters, 113, 8. doi:http://dx.doi.org/10.5849/jof.14-135

McKinley, D. C., Ryan, M. G., Birdsey, R. A., Giardina, C. P., Harmon, M. E., Heath, L. S., . . . Skog, K. E. (2011). A synthesis of current knowledge on forests and carbon storage in the United States. Ecological Applications, 21(6), 1902-1924. doi:10.1890/10-0697.1

McKinney, S. T., & Tomback, D. F. (2011). Chapter 2: Altered Community Dynamics in Rocky Mountain Whitebark Pine Forests and the Potential for Accelerating Declines. In K. E. Richards (Ed.), Mountain Ecosystems: Dynamics, Management and Conservation (pp. 45-78). NY: Nova Science Publishers.

McKinney, S. T., Fiedler, C. E., & Tomback, D. F. (2009). Invasive pathogen threatens bird-pine mutualism: implications for sustaining a high-elevation ecosystem. Ecological Applications, 19(3), 597-607. doi:10.1890/08-0151.1

McKinney, S. T., Tomback, D. F., & Fiedler, C. E. (2011). Altered species interactions and implications for natural regeneration in whitebark pine communities. In: Keane, Robert E.; Tomback, Diana F.; Murray, Michael P.; Smith, Cyndi M., eds. The future of high-elevation, five-needle white pines in Western North America: Proceedings of the High Five Symposium. 28-30 June 2010; Missoula, MT. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/38195; http://www.fs.fed.us/rm/pubs/rmrs_p063/rmrs_p063_056_060.pdf

McLellan, B. N. (1994). Density dependent population regulation of brown bears. In M. Taylor (Ed.), Density dependent population regulation in black, brown, and polar bears. 9th International Conference on Bear Research and Management Monograph Series No. 3. (pp. 15-24). Portland, OR: International Association for Bear Research and Management.

McLellan, B. N. (2015). Some mechanisms underlying variation in vital rates of grizzly bears on a multiple use landscape. Journal of Wildlife Management, 79(5), 749-765. doi:10.1002/jwmg.896

McLellan, B. N., & Hovey, F. W. (1995). The diet of grizzly bears in the Flathead River drainage of southeastern British Columbia. Canadian Journal of Zoology, 73(4), 704-712. doi:10.1139/z95-082

McLellan, B. N., & Shackleton, D. M. (1988). Grizzly Bears and Resource-Extraction Industries - Effects of Roads on Behavior, Habitat Use and Demography. Journal of Applied Ecology, 25(2), 451-460. doi:10.2307/2403836

McLeod, C. M. (2003). Site Identification Strategy prepared for Bitterroot, Flathead, and Lolo National Forests, USDA Forest Service, Northern Region (Montana and Idaho). Retrieved from Missoula, MT:

Mclntyre, J. D., & Rieman, B. E. (1995). Chapter 1: Westslope Cutthroat Trout. In M. K. Young (Ed.), Conservation assessment for inland cutthroat trout. General Technical Report RM-256 (pp. 1-15). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Mech, L. D., Fritts, S. H., Radde, G. L., & Paul, W. J. (1988). Wolf Distribution and Road Density in Minnesota. Wildlife Society Bulletin, 16(1), 85-87.

Meehan, W. R., Merrell, T. R., & Hanley, T. A. (1984). Fish and wildlife relationships in old-growth forests: Proceedings of a symposium held in Juneau, Alaska, 12-15 April 1982: American Institute of Fishery Research Biologists, Alaska District.

Memorandum of understanding between the U.S. Department of Agriculture, Forest Service and the U.S. Fish and Wildlife Service to promote the conservation of migratory birds (FS Agreement# 08-MU-1113-2400-264), (2008).

Merigliano, M. F., & Lesica, P. (1998). The native status of reed canary grass (Phalaris arundinacea L.) in the inland Northwest, USA. Natural Areas Journal, 18(3), 223-230.

Michnevich, A. J., Rue, T., Christensen, J., Forbes, D., Hale, S., Jenson, J., . . . Spaeth, J. (2013). Granite County Growth Policy Plan, Granite County, Montana, approved December 17, 2012. Retrieved from http://co.granite.mt.us/wp-content/uploads/2014/02/GrowthPolicy_2013.pdf

Milburn, A., Bollenbacher, B., Manning, M., & Bush, R. (2015). Region 1 Exisiting and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. Retrieved from Missoula, MT: http://www.fs.usda.gov/detailfull/r1/landmanagement/gis/?cid=stelprdb5331054&width=full

Milburn, Amanda; Bollenbacher, Barry, Manning Mary, and Bush, Renate. 2015. Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. R1 Veg. Classification, Mapping, Inventory and Analysis report 15-4 v1.0. USDA Forest Service, Region 1, Missoula, MT. November 13, 2015. http://fsweb.r1.fs.fed.us/forest/inv/r1_tools/R1_allVeg_Groups.pdf

Milburn, Amanda; Bollenbacher, Barry, Manning Mary, and Bush, Renate. 2015. Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. R1 Veg. Classification, Mapping, Inventory and Analysis report 15-4 v1.0. USDA Forest Service, Region 1, Missoula, MT. November 13, 2015. http://fsweb.r1.fs.fed.us/forest/inv/r1_tools/R1_allVeg_Groups.pdf

Millar, C. I., Stephenson, N. L., & Stephens, S. L. (2007). Climate change and forests of the future: Managing in the face of uncertainty. Ecological Applications, 17(8), 2145-2151. doi:10.1890/06-1715.1

Miller, C. R., & Waits, L. P. (2003). The history of effective population size and genetic diversity in the Yellowstone grizzly (Ursus arctos): Implications for conservation. Proceedings of the National Academy of Sciences of the United States of America, 100(7), 4334-4339. doi:10.1073/pnas.0735531100

Miller, D., Luce, C., & Benda, L. (2003). Time, space, and episodicity of physical disturbance in streams. Forest Ecology and Management, 178(1-2), 121-140. doi:10.1016/S0378-1127(03)00057-4

Miller, M. (1978). Effect of growing season on sprouting of blue huckleberry Retrieved from Ogden, UT: https://archive.org/stream/effectofgrowings240mill/effectofgrowings240mill_djvu.txt

Mills, L. S., Griffin, P. C., Hodges, K. E., McKelvey, K., Ruggiero, L., & Ulizio, T. J. (2005). Pellet count indices compared to mark-recapture estimates for evaluating snowshoe hare density. Journal of Wildlife Management, 69(3), 1053-1062. doi:10.2193/0022-541x(2005)069[1053:Pcictm]2.0.Co;2

Mills, L. S., Zimova, M., Oyler, J., Running, S., Abatzoglou, J. T., & Lukacs, P. M. (2013). Camouflage mismatch in seasonal coat color due to decreased snow duration. Proceedings of the National Academy of Sciences of the United States of America, 110(18), 7360-7365. doi:10.1073/pnas.1222724110

Mills, L. S., Zimova, M., Oyler, J., Running, S., Abatzoglou, J. T., & Lukacs, P. M. (2013). Correction for Mills et al., Camouflage mismatch in seasonal coat color due to decreased snow duration. Proceedings of the National Academy of Sciences of the United States of America, 110(28), 11660–11661. doi:10.1073/pnas.1310823110

Minore, D. (1984). Vaccinium Membranaceum Berry Production 7 Years after Treatment to Reduce Overstory Tree Canopies. Northwest Science, 58(3), 208-212.

MNHP. (2013). Summary Report: Winter 2012 – 2013 (updated from report submitted Hobo Data Logger Deployment and Bat Roost Observations for Columbia Mountain Cave (Cave ID 225) Flathead County Montana. Retrieved from No URL found.

MNHP. (2014). HOBO Data Logger retrieval and bat roost observations for Columbia Mountain Cave (Cave ID 225) Flathead County, Montana January 20, 2014. Retrieved from No URL found

MNHP-MTFWP. (2015). American Three-toed Woodpecker - Picoides dorsalis. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://fieldguide.mt.gov/speciesDetail.aspx?elcode=ABNYF07110

MNHP-MTFWP. (2015). Bobcat - Lynx rufus. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://fieldguide.mt.gov/speciesDetail.aspx?elcode=AMAJH03020

MNHP-MTFWP. (2015). Dusky Grouse - Dendragapus obscurus. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://fieldguide.mt.gov/speciesDetail.aspx?elcode=ABNLC09020

MNHP-MTFWP. (2015). Northern Bog Lemming - Synaptomys borealis. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://FieldGuide.mt.gov/speciesDetail.aspx?elcode=AMAFF17020

MNHP-MTFWP. (2015). Northern Leopard Frog - Lithobates pipiens. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://fieldguide.mt.gov/speciesDetail.aspx?elcode=AAABH01170

MNHP-MTFWP. (2015). Peregrine Falcon - Falco peregrinus. Montana Field Guide, Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://FieldGuide.mt.gov/speciesDetail.aspx?elcode=ABNKD06070

MNHP-MTFWP. (2015). Townsend's Big-eared Bat - Corynorhinus townsendii. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved from http://fieldguide.mt.gov/speciesDetail.aspx?elcode=AMACC08010

MNHP-MTFWP. (2016). Western Toad — Anaxyrus boreas. Montana Field Guide. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks. Retrieved on February 1, 2016, from http://FieldGuide.mt.gov/speciesDetail.aspx?elcode=AAABB01030. Retrieved from http://fieldguide.mt.gov/speciesDetail.aspx?elcode=AAABB01030

MNHP-MTFWP. Montana Field Guide. Available online at http://fieldguide.mt.gov/default.aspx. from Montana Natural Heritage Program and Montana Fish, Wildlife and Parks http://fieldguide.mt.gov/default.aspx

MNWP. (2015). Montana Noxious Weed List (2015). Retrieved from Helena, MT: http://agr.mt.gov/agr/Programs/Weeds/

Montag, J. M., Patterson, M. E., & Sutton, B. (2003). Political & Social Viability of Predator Compensation Programs in the West. Retrieved from Missoula, Montana: http://www.reeis.usda.gov/web/crisprojectpages/0183847-predator-compensation-project.html

Montana Department of Natural Resources and Conservation [MT DNRC]. (2010). Montana statewide forest resource strategy. 34 p. Missoula, MT. Retrieved from: http://dnrc.mt.gov/divisions/forestry/docs/assistance/saresponsestrategy2010.pdf.

Montana Department of Natural Resources and Conservation [MT DNRC]. (2010). Montana statewide forest resource strategy. 34 p. Missoula, MT. Retrieved from: http://dnrc.mt.gov/divisions/forestry/docs/assistance/saresponsestrategy2010.pdf.

Moody, J. A., & Martin, D. A. (2001). Initial hydrologic and geomorphic response following a wildfire in the Colorado Front Range. Earth Surface Processes and Landforms, 26(10), 1049-1070. doi:10.1002/esp.253

Moody, J. A., & Martin, D. A. (2001). Post-fire, rainfall intensity-peak discharge relations for three mountainous watersheds in the western USA. Hydrological Processes, 15(15), 2981-2993. doi:10.1002/hyp.386

Moore, A., & Waring, C. P. (1996). Sublethal effects of the pesticide Diazinon on olfactory function in mature male Atlantic salmon parr. Journal of Fish Biology, 48(4), 758-775. doi:10.1006/jfbi.1996.0075

Morgan, J. T. (1993). Summer habitat use of white-tailed deer on the Tally Lake Ranger District, Flathead National Forest. (PhD dissertation), Montana State University, Bozeman, MT. Retrieved from http://scholarworks.montana.edu/xmlui/bitstream/handle/1/7253/31762102084744.pdf?sequence=1

Morgan, J. T. (2006). White-tailed Deer Studies in the Salish Mountains, Northwest Montana. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/management/deer/default.html

Morgan, T. A., & Baldridge, J. (2015). Understanding Costs and Other Impacts of Litigation of Forest Service Projects: A Region One Case Study. Retrieved from Missoula, MT: http://www.bber.umt.edu/FIR/P_Pubs.asp http://www.bber.umt.edu/pubs/forest/BBERLitigationRpt2015.pdf

Morgan, Todd A. and John Baldridge. 2015. Understanding Costs and Other Impacts of Litigation of Forest Service Projects: A Region One Case Study. Bureau of Business and Economic Research. The University of Montana – Missoula. 17 pages.

Morgan, Todd A. and John Baldridge. 2015. Understanding Costs and Other Impacts of Litigation of Forest Service Projects: A Region One Case Study. Bureau of Business and Economic Research. The University of Montana – Missoula. 17 pages.

Morrison, J., Quick, M. C., & Foreman, M. G. G. (2002). Climate change in the Fraser River watershed: flow and temperature projections. Journal of Hydrology, 263(1-4), 230-244. doi:10.1016/S0022-1694(02)00065-3

Moskoff, W. (1995 (revised 2005)). Veery (Catharus fuscescens). In: A. Poole and F. Gill, eds. The Birds of North America, Number 142. Washington D.C.: The Academy of Natural Sciences, Philadelphia and The American Ornithologists Union.

Mote, P. W., Parson, E. A., Hamlet, A. F., Keeton, W. S., Lettenmaier, D., Mantua, N., . . . Snover, A. K. (2003). Preparing for climatic change: the water, salmon, and forests of the Pacific Northwest. Climatic Change, 61(1-2), 45-88. doi:10.1023/A:1026302914358

MPI. (2015). Montana peregrine falcon population. Retrieved from http://www.montanaperegrine.org/index.html and http://www.montanaperegrine.org/Populations.html

MTANSTC. (2002). Montana Aquatic Nuisance Species (ANS) Management Plan, Final. Retrieved from http://www.anstaskforce.gov/default.php; http://www.fws.gov/answest/

MT-CLWG. (2013). Status of the Common Loon for the Flathead National Forest's LRMP revision effort. Retrieved from Bull Lake, MT:

MTDEQ. (2007). State of Montana Modeling Guidline for Air Quality Permit Applications (Draft). Retrieved from Helena, MT: http://deq.mt.gov/airmonitoring/nwHome.mcpx

MTDEQ. (2014). Montana 2014 Final Water Quality Integrated Report. Retrieved from Helena, MT: http://deq.mt.gov/Portals/112/Water/wqpb/cwaic/Reports/IRs/2014/2014FinalIR.pdf

MTDEQ. (2015). State of Montana Air Quality Monitoring Network Plan. Retrieved from Helena, MT: http://deq.mt.gov/airmonitoring/nwHome.mcpx

MTDNRC. (2010). Forested State Trust Lands Final Habitat Conservation Plan and Environmental Impact Statement. Retrieved from Helena, MT: http://dnrc.mt.gov/divisions/trust/docs/forest-management/hcp; http://dnrc.mt.gov/divisions/trust/docs/forest-management/hcp/eis

MTDNRC. (2010). Montana Statewide Forest Resource Strategy. Retrieved from Missoula, MT: http://dnrc.mt.gov/divisions/forestry/docs/assistance/saresponsestrategy2010.pdf

MTDNRC. (2011). Record of Decision, Forested State Trust Lands Final Habitat Conservation Plan and Environmental Impact Statement. Retrieved from Helena, MT: http://dnrc.mt.gov/divisions/trust/docs/forest-management/hcp

MTFWP. (2003). Final EIS Gray Wolf Conservation and Management Plan. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/management/wolf/management.html; http://fwp.mt.gov/fishAndWildlife/management/wolf/finalWolfEIS.html

MTFWP. (2004). Amended Record of Decision, Montana Gray Wolf Conservation and Management Plan, May 2004. Retrieved from http://fwp.mt.gov/fishAndWildlife/management/wolf/management.html

MTFWP. (2006). Ecology of white-tailed deer in the Salish Mountains, Northwest Montana. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/diseasesAndResearch/research/deer/default.html

MTFWP. (2010). Montana Bighorn Sheep Conservation Strategy. Retrieved from Helena, MT: http://fwpiis.mt.gov/content/getItem.aspx?id=39746

MTFWP. (2013). Vital rates, limiting factors and monitoring methods for moose in Montana. Retrieved from Missoula, MT: http://fwp.mt.gov/fishAndWildlife/diseasesAndResearch/research/moose/populationsMonitoring/default.html

MTFWP. (2014). 2014 Elk Hunting Outlook, Thursday, September 18, 2014. Montana Fish, Wildlife and Parks. Retrieved from http://fwp.mt.gov/news/newsReleases/hunting/nr_2180.html

MTFWP. (2014). Vital rates, limiting factors and monitoring methods for moose in Montana. Retrieved from Missoula, MT: http://fwp.mt.gov/fishAndWildlife/diseasesAndResearch/research/moose/populationsMonitoring/default.html

MTFWP. (2015). Furbearer / Trapping Guide, Montana Fish, Wildlife and Parks. Retrieved from http://fwp.mt.gov/hunting/planahunt/huntingGuides/furbearer/

MTFWP. (2015). Montana statewide elk management plan and population status charts and objective maps. Montana Fish, Wildlife, and Parks. Retrieved from http://fwp.mt.gov/fishAndWildlife/management/elk/ and http://fwp.mt.gov/fishAndWildlife/management/elk/managementPlan.html

MTFWP. (2015). Montana's 2015 State Wildlife Action Plan Final. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/conservationInAction/actionPlan.htmlhttp://fwp.mt.gov/fishAndWildlife/conservationInAction/swap2015Plan.html

MTFWP. (2015). Vital rates, limiting factors and monitoring methods for moose in Montana. Retrieved from Missoula, MT: http://fwp.mt.gov/fishAndWildlife/diseasesAndResearch/research/moose/populationsMonitoring/default.html

Muhlfeld, C. C., Kalinowski, S. T., McMahon, T. E., Taper, M. L., Painter, S., Leary, R. F., & Allendorf, F. W. (2009). Hybridization rapidly reduces fitness of a native trout in the wild. Biology Letters, 5(3), 328-331. doi:10.1098/rsbl.2009.0033

Muhlfeld, C. C., Kovach, R. P., Jones, L. A., Al-Chokhachy, R., Boyer, M. C., Leary, R. F., . . . Allendorf, F. W. (2014). Invasive hybridization in a threatened species is accelerated by climate change. Nature Climate Change, 4(7), 620-624. doi:10.1038/Nclimate2252

Muhlfeld, C. C., McMahon, T. E., Belcer, D., & Kershner, J. L. (2009). Spatial and temporal spawning dynamics of native westslope cutthroat trout, Oncorhynchus clarkii lewisi, introduced rainbow

trout, Oncorhynchus mykiss, and their hybrids. Canadian Journal of Fisheries and Aquatic Sciences, 66(7), 1153-1168. doi:10.1139/F09-073

Muhlfeld, C. C., McMahon, T. E., Boyer, M. C., & Gresswell, R. E. (2009). Local Habitat, Watershed, and Biotic Factors Influencing the Spread of Hybridization between Native Westslope Cutthroat Trout and Introduced Rainbow Trout. Transactions of the American Fisheries Society, 138(5), 1036-1051. doi:10.1577/T08-235.1

Mundinger, J. G. (1984). Biology of the white-tailed deer in the coniferous forest of northwestern Montana. Pages 275-284. In: W. R. Meehan, T. R. Merrell, Jr., and T. A. Hanley, eds. Proceedings of fish and wildlife relationships in old-growth forests: Proceedings of a symposium held in Juneau, Alaska, 12-15 April 1982. Retrieved from Reference to main proceeding only at http://agris.fao.org/agris-search/search.do?recordID=US8830464

Murray, M. (2005). Our Threatened Timberlines: The Plight of Whitebark Pine Ecosystems. Kalmiopsis [Native Plant Society of Oregon], 12, 25-29.

Naiman, R. J., Beechie, T. J., Benda, L. E., Berg, D. R., Bison, P. A., MacDonald, L. H., . . . Steel, E. A. (1992). Chapter 6: Fundamental Elements of Ecologically Healthy Watersheds in the Pacific Northwest Coastal Ecoregion. In: Naiman, Robert J., Watershed Management: Balancing Sustainability with Environmental Change. Springer-Verlag, New York. Pages 127-188.

Naney, R. H., Finley, L. L., Lofroth, E. C., Happe, P. J., Krause, A. L., Raley, C. M., . . . Yaeger, J. S. (2012). Conservation of Fishers (Martes pennanti) in South-Central British Columbia, Western Washington, Western Oregon, and California–Volume III: Threat Assessment. Retrieved from Denver, Colorado, USA: http://www.fws.gov/yreka/PDF/Naney_etal_2012.pdf

Nappi, A., & Drapeau, P. (2009). Reproductive success of the black-backed woodpecker (Picoides arcticus) in burned boreal forests: Are burns source habitats? Biological Conservation, 142(7), 1381-1391. doi:10.1016/j.biocon.2009.01.022

National Vegetation Classification System, Version 2, Feb. 2008. (2008). Vegetation Subcommittee, Federal Geographic Data Committee. FGDC-STD-005-2008.

Nehlsen, W., Williams, J. E., & Lichatowich, J. A. (1991). Pacific Salmon at the Crossroads - Stocks at Risk from California, Oregon, Idaho, and Washington. Fisheries, 16(2), 4-21. doi:10.1577/1548-8446(1991)016<0004:PSATCS>2.0.CO;2

Neuenschwander, L.F., J.W. Byler, A E. Harvey, G I. McDonald, D.S. Ortiz, H.L. Osborne, G.C. Snyder, and A. Zack. 1999. White Pine in the American West: A Vanishing Species—Can We Save It? USDA Forest Service, Rocky Mountain Research station. General Technical Report RMRS-GTR-35.

Neuenschwander, L.F., J.W. Byler, A E. Harvey, G I. McDonald, D.S. Ortiz, H.L. Osborne, G.C. Snyder, and A. Zack. 1999. White Pine in the American West: A Vanishing Species—Can We Save It? USDA Forest Service, Rocky Mountain Research station. General Technical Report RMRS-GTR-35.

Newell, R. L., & Minshall, G. W. (1976). An annotated list of the aquatic insects of southeastern Idaho. Part 1: Plecoptera. Great Basin Naturalist, 36(4), 501-504.

Newlon, K. R., & Burns, M. D. (2010). Wetlands of the Flathead Valley: Change and Ecological Functions. Retrieved from http://mtnhp.org/Reports/Flathead_Change_Revised.pdf

Northrup, J. M., Stenhouse, G. B., & Boyce, M. S. (2012). Agricultural lands as ecological traps for grizzly bears. Animal Conservation, 15(4), 369-377. doi:10.1111/j.1469-1795.2012.00525.x

NRAP. (2015). Northern Rockies Adaptation Partnership: Vulnerability Assessment Summaries (Draft) http://adaptationpartners.org/nrap/va_ap.php. Retrieved from http://adaptationpartners.org/nrap/va_ap.php; http://adaptationpartners.org/nrap/docs/NRAP_vulnerability_assessment.pdf

Nussbaum, R. A., Brodie, E. D., & Storm, R. M. (1983). Amphibians and reptiles of the Pacific Northwest. Moscow, Idaho: University Press of Idaho.

Oakleaf, J. K., Murray, D. L., Oakleaf, J. R., Bangs, E. E., Mack, C. M., Smith, D. W., . . . Niemeyer, C. C. (2006). Habitat selection by recolonizing wolves in the Northern Rocky Mountains of the United States. Journal of Wildlife Management, 70(2), 554-563. doi:http://dx.doi.org/10.2193/0022-541X(2006)70[554:HSBRWI]2.0.CO;2

O'Brien, J. M., O'Brien, C. S., McCarthy, C., & Carpenter, T. E. (2014). Incorporating Foray Behavior Into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep. Wildlife Society Bulletin, 38(2), 321-331. doi:10.1002/wsb.387

Oelfke, J. G., & Butler, D. R. (1985). Landslides along the Lewis Overthrust Fault, Glacier National Park, Montana. The Geographical Bulletin, 27(1), 7-15.

Olander, L., Johnston, R. J., Tallis, H., Kagan, J., Maguire, L., Polasky, S., . . . Palmer, M. (2015). Best Practices for Integrating Ecosystem Services into Federal Decision Making. Retrieved from Durham, NC: https://nicholasinstitute.duke.edu/sites/default/files/publications/es_best_practices_fullpdf_0.pdf

Olson, L. E., Sauder, J. D., Albrecht, N. M., Vinkey, R. S., Cushman, S. A., & Schwartz, M. K. (2014). Modeling the effects of dispersal and patch size on predicted fisher (Pekania [Martes] pennanti) distribution in the U.S. Rocky Mountains. Biological Conservation, 169, 89-98. doi:10.1016/j.biocon.2013.10.022

Orme, M. L., & Williams, R. G. (1986). Coordinating livestock and timber management with the grizzly bear in Situation 1 Habitat, Targhee National Forest. In: Proceedings - Grizzly Bear Habitat Symposium, April 30 - May 2, 1985, edited by Glen P. Contreras and Keith E. Evans, 195-203. Retrieved from Ogden, UT: https://archive.org/details/CAT86869131; https://ia902602.us.archive.org/28/items/CAT86869131/CAT86869131.pdf

Oswald, E. T., & Brown, B. N. (1993). Vegetation Development on Skid Trails and Burned Sites in Southeastern British-Columbia. Forestry Chronicle, 69(1), 75-80.

Pac, H. I., & Dood, A. R. (1998). Five year update of the programmatic environmental impact statement: the grizzly bear in northwestern Montana 1991-1995. Retrieved from Helena, MT: No URL found

Paetkau, D., Waits, L. P., Clarkson, P. L., Craighead, L., Vyse, E., Ward, R., & Strobeck, C. (1998). Variation in genetic diversity across the range of North American brown bears. Conservation Biology, 12(2), 418-429. doi:10.1046/j.1523-1739.1998.96457.x

Page-Dumroese, D. S., Jurgensen, M., & Terry, T. (2010). Maintaining soil productivity during forest or biomass-to-energy thinning harvests in the western United States. Western Journal of Applied Forestry, 25(1), 5-11.

Pan, Y. D., Birdsey, R. A., Fang, J. Y., Houghton, R., Kauppi, P. E., Kurz, W. A., . . . Hayes, D. (2011). A Large and Persistent Carbon Sink in the World's Forests. Science, 333(6045), 988-993. doi:10.1126/science.1201609

Patla, S. M. (2005). Monitoring results of Northern Goshawk nesting areas in the greater yellowstone ecosystem: Is decline in occupancy related to habitat change? Journal of Raptor Research, 39(3), 324-334.

Pederson, G. T., Fagre, D. B., Gray, S. T., & Graumlich, L. J. (2004). Decadal-scale climate drivers for glacial dynamics in Glacier National Park, Montana, USA. Geophysical Research Letters, 31(12), 4. doi:10.1029/2004gl019770

Petersen, J. H., & Kitchell, J. F. (2001). Climate regimes and water temperature changes in the Columbia River: bioenergetic implications for predators of juvenile salmon. Canadian Journal of Fisheries and Aquatic Sciences, 58(9), 1831-1841. doi:10.1139/cjfas-58-9-1831

Pettit, N. E., & Naiman, R. J. (2007). Fire in the riparian zone: Characteristics and ecological consequences. Ecosystems, 10(5), 673-687. doi:10.1007/s10021-007-9048-5

Pfister, R. D., Kovalchik, B. L., Amo, S. F., & Presby, R. C. (1977). Forest Habitat Types of Montana. Retrieved from Ogden, UT: http://www.fs.fed.us/rm/pubs_int/int_gtr034.html; http://www.fs.fed.us/rm/pubs_int/int_gtr034.pdf

Pierson, E. D., Wackenhut, M. C., Altenbach, J. S., Bradley, P., Call, P., Genter, D. L., . . . Welch, L. (1999). Species Conservation Assessment and Conservation Strategy for the Townsend's big-eared bat. (Corynorhinus townsendii townsendii and Corynorhinus townsendii pallescens). Boise, Idaho: Idaho Conservation Effort, Idaho Department of Fish and Game.

Pierson, J. C., Allendorf, F. W., Drapeau, P., & Schwartz, M. K. (2013). Breed Locally, Disperse Globally: Fine-Scale Genetic Structure Despite Landscape-Scale Panmixia in a Fire-Specialist. Plos One, 8(6): e67248, 8. doi:10.1371/journal.pone.0067248

Platt, W. S. (1991). Livestock grazing. In W. R. Meehan (Ed.), Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats, American Fisheries Society Special Publication 19 (pp. 389-423). Bethesda, MD: American Fisheries Society.

Poff, B., Koestner, K. A., Neary, D. G., & Henderson, V. (2011). Threats to Riparian Ecosystems in Western North America: An Analysis of Existing Literature. Journal of the American Water Resources Association, 47(6), 1241-1254. doi:10.1111/j.1752-1688.2011.00571.x

Poizat, G., & Pont, D. (1996). Multi-scale approach to species-habitat relationships: juvenile fish in a large river section. Freshwater Biology, 36(3), 611-622. doi:10.1046/j.1365-2427.1996.00129.x

Pollock, M. M., Lewallen, G., Woodruff, K., Jordan, C. E., & Castro, J. M. (2015). The Beaver Restoration Guidebook: Working with Beaver to Restore Streams, Wetlands, and Floodplains. Version 1.0. Retrieved from Portland, OR: http://www.fws.gov/oregonfwo/promo.cfm?id=177175812

Proctor, M. F., McLellan, B. N., Strobeck, C., & Barclay, R. M. R. (2004). Gender-specific dispersal distances of grizzly bears estimated by genetic analysis. Canadian Journal of Zoology-Revue Canadienne De Zoologie, 82(7), 1108-1118. doi:10.1139/z04-077

Proctor, M. F., Paetkau, D., Mclellan, B. N., Stenhouse, G. B., Kendall, K. C., Mace, R. D., . . . Strobeck, C. (2012). Population fragmentation and inter-ecosystem movements of grizzly bears in western Canada and the northern United States. Wildlife Monographs(180), 1-46. doi:10.1002/Wmon.6

Quigley, T. M. (1997). The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. Retrieved from Portland, OR: http://www.fs.fed.us/pnw/publications/pnw_gtr405/

Quigley, T. M., & Arbelbide, S. J. (1997). An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great basins. Volume 1. Available online at http://www.fs.fed.us/pnw/publications/pnw_gtr405/. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/24921/ http://www.fs.fed.us/pnw/publications/pnw_gtr405/; http://purl.access.gpo.gov/GPO/LPS116289

Rahel, F. J., & Olden, J. D. (2008). Assessing the effects of climate change on aquatic invasive species. Conservation Biology, 22(3), 521-533. doi:10.1111/j.1523-1739.2008.00950.x

Reeves, G. H., Benda, L. E., Burnett, K. M., Bisson, P. A., & Sedell, J. R. (1995). A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionary significant units of anadromous salmonids in the Pacific Northwest. Part Five: Ecosystems and Habitat. In J. L. Nielsen & D. A. Powers (Eds.), Symposium 17: Proceedings of the Symposium on Evolution and the Aquatic Ecosystem: Defining Unique Units in Population Conservation, held at Monterey, California, USA, 23-25 May 1994. . Bethesda, MD: American Fisheries Society.

Regier, H. A. (1993). The notion of natural and cultural integrity. In S. Woodley, J. Kay, & G. Francis (Eds.), Ecological Integrity and the Management of Ecosystems (pp. 3-18). Delray Beach, FL: St. Lucie Press.

Reichel, J. D., & Beckstrom, S. G. (1994). Northern bog lemming survey: 1993. Retrieved from Helena, MT: http://mtnhp.org/animal/reports/mammals/NBL_survey_1993.pdf; http://mtnhp.org/Reports.asp?key=7

Reichel, J. D., & Corn, J. G. (1997). Northern bog lemmings: survey, population parameters, and population analysis. Retrieved from Helena, MT: http://mtnhp.org/animal/reports/mammals/NBLSurvey_pop_parm_anly.pdf

Reichel, J. D., & Genter, D. L. (1996). Harlequin Duck Surveys in Western Montana: 1995. Retrieved from Helena, MT: https://ia902308.us.archive.org/24/items/harleoct1996quinducksurreicrich/harleoct1996quinducksurreicrich.pdf; https://archive.org/details/harleoct1996quinducksurreicrich

Resler, L. M., & Tomback, D. F. (2008). Blister Rust Prevalence in Krummholz Whitebark Pine: Implications for Treeline Dynamics, Northern Rocky Mountains, Montana, U.S.A. Arctic, Antarctic, and Alpine Research, 40(1), 161-170. doi:http://www.jstor.org/stable/20181776

Reyes, Brian and Renate Bush. 2015. Overview of FIA and Intensified Grid Data. Region 1 Vegetation Classification, Inventory, and Analysis Report #15-12 v.3.0. December 22, 2015.

Reyes, Brian and Renate Bush. 2015. Overview of FIA and Intensified Grid Data. Region 1 Vegetation Classification, Inventory, and Analysis Report #15-12 v.3.0. December 22, 2015.

Reynolds, R. T., Graham, R. T., & Boyce Jr., D. A. (2008). Northern goshawk habitat: an intersection of science, management, and conservation. Journal of Wildlife Management, 72(4), 1047-1055. doi:http://dx.doi.org/10.2193/2007-131

Reynolds, R. T., Graham, R. T., & Reiser, M. H. (1992). Management recommendations for the northern goshawk in the southwestern United States. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/6420; http://www.fs.fed.us/rm/pubs_rm/rm_gtr217.pdf

Rieman, B. E., & Clayton, J. L. (1997). Wildlife and native fish: issues of forest health and conservation of sensitive species. Fisheries, 22(11), 6-15. doi:10.1577/1548-8446(1997)022<0006:Wanfio>2.0.Co;2

Rieman, B. E., & Isaak, D. J. (2010). Climate change, aquatic ecosystems, and fishes in the Rocky Mountain West: implications and alternatives for management. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/37029

Rieman, B. E., & McIntyre, J. D. (1995). Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society, 124(3), 285-296. doi:10.1577/1548-8659(1995)124<0285:Oobtin>2.3.Co;2

Rieman, B. E., Isaak, D. J., Adams, S., Horan, D., Nagel, D., Luce, C., & Myers, D. (2007). Anticipated climate warming effects on bull trout habitats and populations across the interior Columbia River basin. Transactions of the American Fisheries Society, 136(6), 1552-1565. doi:10.1577/T07-028.1

Rieman, B. E., Lee, D. C., & Thurow, R. F. (1997). Distribution, Status, and Likely Future Trends of Bull Trout within the Columbia River and Klamath River Basins. North American Journal of Fisheries Management, 17(4), 1111-1125. doi:10.1577/1548-8675(1997)017<1111:DSALFT>2.3.CO;2

Rieman, B. E., Lee, D. C., Thurow, R. F., Hessburg, P. F., & Sedell, J. R. (2000). Toward an integrated classification of ecosystems: Defining opportunities for managing fish and forest health. Environmental Management, 25(4), 425-444. doi:10.1007/s002679910034

Rieman, B. E., Smith, C. L., Naiman, R. J., Ruggerone, G. T., Wood, C. C., Huntly, N., . . . Smouse, P. (2015). A Comprehensive Approach for Habitat Restoration in the Columbia Basin. Fisheries, 40(3), 124-135. doi:http://dx.doi.org/10.1080/03632415.2015.1007205

Rieman, B., Luce, C. H., Dunham, J. B., & Rosenberger, A. L. (2005). Implications of changing fire regimes for aquatic ecosystems. In L. Taylor, J. Zelnik, S. Cadwallader, & B. Hughs (Eds.), Mixed severity fire regimes: ecology and management; Symposium proceedings, Association for Fire Ecology and Wshington State University, Spokane, WA; November 17-19, 2004 (pp. 187-191). Pullman, WA: Washington State University Extension.

Rimbey, N., & Torell, L. A. (2011). Grazing Costs: What's the Current Situation? Retrieved from Moscow, ID: https://www.google.com/#q=rimbey+torell+2011+grazing+costs

Ritter, J., & Maxell, B. (2012). Black Swift Distribution Modeling. Retrieved from http://fieldguide.mt.gov

Ritter, J., & Maxell, B. (2012). Common Loon Distribution Modeling. Retrieved from http://fieldguide.mt.gov

ROD http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5133419.pdf

Rollins, M. G., Morgan, P., & Swetnam, T. (2002). Landscape-scale controls over 20th century fire occurrence in two large Rocky Mountain (USA) wilderness areas. Landscape Ecology, 17(6), 539-557. doi:10.1023/A:1021584519109

Rollins, M.G., Morgan, P., & Swetnam, T. (2002). Landscape-scale controls over 20th century fire occurrence in two large Rocky Mountain (USA) wilderness areas. Landscape Ecology, 17, 539-557.

Rollins, M.G., Morgan, P., & Swetnam, T. (2002). Landscape-scale controls over 20th century fire occurrence in two large Rocky Mountain (USA) wilderness areas. Landscape Ecology, 17, 539-557.

Rosenberger, Randall S.; Loomis, John B. 2001. Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Rosenthal, L., Fredenberg, W., & Steed, A. (2015). Experimental Removal of Lake Trout in Swan Lake, MT. Retrieved from http://montanatu.org/wp-content/uploads/2015/05/2014-SVBTWG_-Annual-Report.pdf

Rowland, M. M., & Vojta, C. D. (2013). A Technical Guide for Monitoring Wildlife Habitat. Retrieved from Washington, DC: http://www.fs.fed.us/research/publications/gtr/gtr_wo89/gtr_wo89.pdf; http://www.treesearch.fs.fed.us/pubs/45213

Ruby, M. (2014). Evaluation of Grizzly Bear (Ursus Arctos) Movement and Habitat Use in Relationship to Human Development in the Swan-Clearwater Valleys, Montana, Paper 4344. (Master of Science), University of Montana, Missoula, MT. Retrieved from http://scholarworks.umt.edu/do/search/?q=ruby%20grizzly&start=0&context=4678273; http://scholarworks.umt.edu/etd/4344/

Ruggiero, L. F., Aubry, K. B., Buskirk, S. W., Koehler, G. M., Krebs, C. J., McKelvey, K. S., & Squires, J. R. (1999). Ecology and Conservation of Lynx in the United States. Retrieved from Fort Collins, CO: http://www.fs.fed.us/rm/pubs/rmrs_gtr030.html; http://www.treesearch.fs.fed.us/pubs/4546

Ruggiero, L. F., Aubry, K. B., Buskirk, S. W., Lyon, L. J., & Zielinski, W. J. (1994). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Retrieved from Fort Collins, CO: http://www.fs.fed.us/rm/pubs_rm/rm_gtr254.pdf; http://www.treesearch.fs.fed.us/pubs/6421

Running, S. W. (2006). Is global warming causing more, larger wildfires? Science, 313(5789), 927-928. doi:10.1126/science.1130370

Running, S.W. 2006. Is global warming causing more, larger wildfires? Science 313: 927-928.

Running, S.W. 2006. Is global warming causing more, larger wildfires? Science 313: 927-928.

Ryan, M. G., Harmon, M. E., Birdsey, R. A., Giardina, C. P., Heath, L. S., Houghton, R. A., . . . Skog, K. E. (2010). A Synthesis of the Science on Forests and Carbon for U.S. Forests. Retrieved from http://www.fs.fed.us/rm/pubs_other/rmrs_2010_ryan_m002.pdf

Ryan, M. G., Kashian, D. M., Smithwick, E. A. H., Romme, W. H., Turner, M. G., & Tinker, D. B. (2008). Final Report on Carbon cycling at the landscape scale: the effect of changes in climate and fire frequency on age distribution, stand structure, and net ecosystem production. Retrieved from http://www.firescience.gov/projects/03-1-1-06/project/03-1-1-06_03-1-1-06_final_report.pdf

Ryan, M., Archer, S., Birdsey, R., Dahm, C., Heath, L., Hicke, J., . . . Schlesinger, W. (2008). Chapter 3: Land Resources The effects of climate change on agriculture, land resources, water resources, and biodiversity. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (pp. 362). Washington, D.C.

Saab, V. A. (1998). Effects of recreational activity and livestock grazing on habitat use by breeding birds in cottonwood forests along the South Fork Snake River. Retrieved from http://www.blm.gov/style/medialib/blm/id/publications/technical_bulletins.Par.90740.File.dat/TB_98-17.pdf

Saab, V. A., & Dudley, J. G. (1998). Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/23853; http://www.fs.fed.us/rm/pubs/rmrs_rp011.pdf

Saab, V. A., Dudley, J., & Thompson, W. L. (2004). Factors influencing occupancy of nest cavities in recently burned forests. Condor, 106(1), 20-36. doi:10.1650/7485

Saab, V. A., Russell, R. E., & Dudley, J. G. (2007). Nest densities of cavity-nesting birds in relation to postfire salvage logging and time since wildfire. The Condor, 109, 97-108.

Safford, H. D., Carlson, C. H., & Schmidt, D. A. (2009). Effects of fuel treatments on fire severity in an area of wildland-urban interface, Angora Fire, Lake Tahoe Basin, California. Forest ecology and management, 258(5), 773-787.

Safford, H. D., Carlson, C. H., & Schmidt, D. A. (2009). Effects of fuel treatments on fire severity in an area of wildland-urban interface, Angora Fire, Lake Tahoe Basin, California. Forest ecology and management, 258(5), 773-787.

Safford, H. D., Schmidt, D. A., & Carlson, C. H. (2009). Effects of fuel treatments on fire severity in an area of wildland-urban interface, Angora Fire, Lake Tahoe Basin, California. Forest Ecology and Management, 258(5), 773-787. doi:10.1016/j.foreco.2009.05.024

Samman, S. & Logan, J. (Eds.). (2000). Assessment and response to bark beetle outbreaks in the Rocky Mountain area. Gen. Tech. Rep. RMRS-GTR-62. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 46 p.

Samman, S. & Logan, J. (Eds.). (2000). Assessment and response to bark beetle outbreaks in the Rocky Mountain area. Gen. Tech. Rep. RMRS-GTR-62. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 46 p.

Samson, F. B. (2005 (amended in 2006)). A conservation assessment of the northern goshawk, black-backed woodpecker, flammulated owl, and pileated woodpecker in the Northern Region, U.S. Department of Agriculture, Forest Service. Retrieved from Missoula, MT: No URL

Satterthwaite, T. D. (1995). Effects of Boat Traffic on Juvenile Salmonids in the Rogue River. Retrieved from Portland, OR: http://soda.sou.edu/awdata/030429a1.pdf

Sauder, J. D., & Rachlow, J. L. (2014). Both forest composition and configuration influence landscape-scale habitat selection by fishers (Pekania pennanti) in mixed coniferous forests of the Northern Rocky Mountains. Forest Ecology and Management, 314, 75-84. doi:10.1016/j.foreco.2013.11.029

Sauer, J. R., Hines, J. E., Fallon, J. E., Pardieck, K. L., Ziolkowski, J., D. J., & Link, W. A. (2014). The North American Breeding Bird Survey, Results and Analysis 1966 - 2013. Retrieved from Laurel, MD: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Savage, M., & Mast, J. N. (2005). How resilient are southwestern ponderosa pine forests after crown fires? Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 35(4), 967-977. doi:10.1139/X05-028

Savoy, L. (2004). Summary of capture and banding efforts and methylmercury exposure to Montana's breeding Common Loon population, 1996-97, 2003. Retrieved from Gorham, ME: http://www.briloon.org/lucas-savoy-b-s#p4

Schaming, T. D. (2015). Population-Wide Failure to Breed in the Clark's Nutcracker (Nucifraga columbiana). Plos One, 10(5). doi:ARTN e0123917; 10.1371/journal.pone.0123917

Schassberger, L. A. (1988). Report on the conservation status of Silene spaldingii, a candidate threatened species. Retrieved from http://ia902708.us.archive.org/11/items/sileneconserva00roelrich/sileneconserva00roelrich.pdf; http://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDCAR0U1S0; https://archive.org/details/sileneconserva00roelrich

Schnackenberg, E. S., & MacDonald, L. H. (1998). Detecting cumulative effects on headwater streams in the Routt National Forest, Colorado. Journal of the American Water Resources Association, 34(5), 1163-1177. doi:10.1111/j.1752-1688.1998.tb04162.x

Scholz, N. L., Truelove, N. K., French, B. L., Berejikian, B. A., Quinn, T. P., Casillas, E., & Collier, T. K. (2000). Diazinon disrupts antipredator and homing behaviors in chinook salmon (Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences, 57(9), 1911-1918. doi:10.1139/cjfas-57-9-1911

Schwandt, J. W. (2006). Whitebark Pine in Peril: A Case for Restoration. Retrieved from Missoula, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5341409.pdf

Schwandt, J. W., Kearns, H. S. J., & Byler, J. W. (2013). Impacts of White Pine Blister Rust and Competition on Natural Whitebark Pine Regeneration in Northern Idaho 1995–2012. Retrieved from http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3795845.pdf

Schwartz, C. C., Haroldson, M. A., & White, G. C. (2010). Hazards Affecting Grizzly Bear Survival in the Greater Yellowstone Ecosystem. Journal of Wildlife Management, 74(4), 654-667. doi:10.2193/2009-206

Schwartz, M. K., Copeland, J. P., Anderson, N. J., Squires, J. R., Inman, R. M., McKelvey, K. S., . . . Cushman, S. A. (2009). Wolverine gene flow across a narrow climatic niche. Ecology, 90(11), 3222-3232. doi:10.1890/08-1287.1

Schwartz, M. K., DeCesare, N. J., Jimenez, B. S., Copeland, J. P., & Melquist, W. E. (2013). Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. Forest Ecology and Management, 305, 103-111. doi:http://dx.doi.org/10.1016/j.foreco.2013.05.014

Sells, S. N., Mitchell, M. S., Nowak, J. J., Lukacs, P. M., Anderson, N. J., Ramsey, J. M., . . . Krausman, P. R. (2015). Modeling Risk of Pneumonia Epizootics in Bighorn Sheep. Journal of Wildlife Management, 79(2), 195-210. doi:10.1002/jwmg.824

Servheen, C. (1981). Grizzly bear ecology and management in the Mission Mountains, Montana. (PhD dissertation), University of Montana, Missoula, MT. Retrieved from No URL found

Servheen, C. (1983). Grizzly bear food-habits, movements, and habitat selection in the Mission Mountains, Montana. Journal of Wildlife Management, 47(4), 1026-1035. doi:10.2307/3808161

Servheen, C., & Cross, M. (2010). Climate change impacts on grizzly bears and wolverines in the Northern U.S. and Transboundary Rockies: Strategies for conservation. Retrieved from Missoula, MT: http://www.igbconline.org/index.php/y-reports/228-climate-change-grizzlies-and-wolverines-transboundary-workshop-report

Servheen, C., & Klaver, R. (1983). Grizzly bear dens and denning activity in the Mission and Rattlesnake Mountains, Montana. Retrieved from http://www.jstor.org/stable/3872539

Shaw, C. (1967). The Flathead Story. USDA publication.

Shelly, J. S. (1988). Status review of Howellia aquatilis, U.S. Forest Service, Region 1, Flathead National Forest. Retrieved from Helena, MT: http://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDCAM0A010; https://archive.org/details/501C980F-1708-4A9A-BFB4-A36F4D5654A5; https://ia800301.us.archive.org/21/items/501C980F-1708-4A9A-BFB4-A36F4D5654A5/501C980F-1708-4A9A-BFB4-A36F4D5654A5.pdf

Shepard, B. B., May, B. E., & Urie, W. (2003). Status of Westslope Cutthroat Trout (Oncorhynchus clarki lewisi) in the United States: 2002. Retrieved from Bozeman, MT: https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Mgt901-101Shepard200%20Status%20of%20Westslope%20Cutthroat%20Trout%20in%20the%20US.pdf

Shepard, B. B., May, B. E., & Urie, W. (2005). Status and conservation of westslope cutthroat trout within the western United States. North American Journal of Fisheries Management, 25(4), 1426-1440. doi:10.1577/M05-004.1

Shepard, B. B., Taper, M., White, R. G., & Ireland, S. C. (1998). Influence of abiotic and biotic factors on abundance of stream-resident westslope cutthroat trout Oncorhynchus clarki lewisi in Montana streams. Final report to U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Boise, Idaho, for contract INT-92682-RJVA. Retrieved from Bozeman, MT: No URL found

Shepard, B. B., Taper, M., White, R. G., & Ireland, S. C. (1998). Influence of physical habitat characteristics, land management, and non-native brook trout (Salvelinus fontinalis) on the density of stream-resident westslope cutthroat trout (Oncorhynchus clarki lewisi) in Montana streams. In B. B. Shepard, M. Taper, & R. G. White (Eds.), Influence of abiotic and biotic factors on abundance of stream-resident westslope cutthroat trout Oncorhynchus clarki lewisi in Montana streams. Final report to U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Boise, Idaho, for contract INT-92682-RJVA (pp. 14-43). Bozeman, MT: Montana Cooperative Fishery Research Unit, Montana State University.

Sherwin, H. A., Montgomery, W. I., & Lundy, M. G. (2013). The impact and implications of climate change for bats. Mammal Review, 43(3), 171-182. doi:10.1111/j.1365-2907.2012.00214.x

Simmons, C. A. (1974). Seasonal Movements and Migration of the Spotted Bear Elk Herd. Retrieved from Missoula, MT: No URL link.

Singer, F. J. (1978). Behavior of mountain goats in relation to United States Highway 2, Glacier National Park, Montana. Journal of Wildlife Management, 42(3), 591-597. doi:10.2307/3800822

Singer, F. J., & Doherty, J. L. (1985). Managing mountain goats at a highway crossing. Wildlife Society Bulletin, 13(4), 469-477.

Skog, K. E. (2008). Sequestration of carbon in harvested wood products for the United States. Forest Products Journal, 58(6), 56-72.

Smith, A. C., Fahrig, L., & Francis, C. M. (2011). Landscape size affects the relative importance of habitat amount, habitat fragmentation, and matrix quality on forest birds. Ecography, 34(1), 103-113. doi:10.1111/j.1600-0587.2010.06201.x

Smith, C. M., Wilson, B., Rasheed, S., Walker, R. C., Carolin, T., & Shepherd, B. (2008). Whitebark pine and white pine blister rust in the Rocky Mountains of Canada and northern Montana. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 38(5), 982-995. doi:10.1139/X07-182

Smith, H. Y. (1999). Assessing longevity of ponderosa pine (Pinus ponderosa) snags in relation to age, diameter, wood density and pitch content. (Master of Science), University of Montana, Missoula, MT. Retrieved from http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=2632&context=etd

Smucker, K., Cilimburg, A., & Fylling, M. (2008). 2008 Flammulated Owl Surveys Retrieved from Missoula, MT: http://avianscience.dbs.umt.edu/research_landbird_flam.htm

Smucker, T., Garrot, B., & Gude, J. (2011). Synthesizing moose management, monitoring, past research and future research needs in Montana. Retrieved from http://fwp.mt.gov/fishAndWildlife/diseasesAndResearch/research/moose/populationsMonitoring/default.html

Sneck, K. M. D. (1977). The fire history Coram Experimental Forest. (Master of Science), University of Montana, Missoula, MT. Retrieved from No URL found

Sopper, W. E. (1975). Effects of Timber Harvesting and Related Management Practices on Water-Quality in Forested Watersheds. Journal of Environmental Quality, 4(1), 24-29.

Sorenson, C. B., McIver, C. P., Keegan, C. E., & Morgan, T. A. (2012). Capacity and capability of mills in the Flathead National Forest timber-processing area. Retrieved from Missoula, MT: http://www.bber.umt.edu/FIR/..%5Cpubs%5CForest%5Ccapacity%5CFlathead_NF_capacity_final.pdf

Sorenson, Colin B.; McIver, Chelsea P.; Keegan, Charles E.; Morgan, Todd A. 2012. Capacity and Capability of Mills in the Flathead National Forest Timber-Processing Area. Bureau of Business and Economic Research. The University of Montana – Missoula. 10 pages.

Sorenson, Colin B.; McIver, Chelsea P.; Keegan, Charles E.; Morgan, Todd A. 2012. Capacity and Capability of Mills in the Flathead National Forest Timber-Processing Area. Bureau of Business and Economic Research. The University of Montana – Missoula. 10 pages.

Spence, B. C., Lomnicky, G. A., Hughes, R. M., & Novitzki, R. P. (1996). An Ecosystem Approach to Salmonid Conservation. Retrieved from Corvallis, OR: http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/the_mantech_report.html

Spreitzer, P. N. (1985). Transitory Range: a New Frontier. Rangelands 7(1), February 1985, 7(1), 33-34.

Squires, J. R., & Kennedy, P. L. (2006). Northern goshawk ecology: An assessment of current knowledge and information needs for conservation and management. Studies in Avian Biology, 31, 8-62.

Squires, J. R., & Reynolds, R. T. (1997). Northern Goshawk (Accipiter gentilis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/298. Retrieved from http://bna.birds.cornell.edu/bna/species/298

Squires, J. R., & Ruggiero, L. F. (2007). Winter Prey Selection of Canada Lynx in Northwestern Montana. The Journal of Wildlife Management, 71(2), 310-315. doi:10.2193/2005-445

Squires, J. R., Copeland, J. P., Ulizio, T. J., Schnvartz, I. K., & Ruggiero, L. F. (2007). Sources and patterns of wolverine mortality in western Montana. Journal of Wildlife Management, 71(7), 2213-2220. doi:10.2193/2007-053

Squires, J. R., DeCesare, N. J., Kolbe, J. A., & Ruggiero, L. F. (2008). Hierarchical den selection of Canada lynx in western Montana. Journal of Wildlife Management, 72(7), 1497-1506. doi:10.2193/2007-396

Squires, J. R., Decesare, N. J., Kolbe, J. A., & Ruggiero, L. F. (2010). Seasonal resource selection of Canada lynx in managed forests of the northern Rocky Mountains. Journal of Wildlife Management, 74(8), 1648-1660. doi:10.2193/2009-184

Squires, J. R., DeCesare, N. J., Olson, L. E., Kolbe, J. A., Hebblewhite, M., & Parks, S. A. (2013). Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery. Biological Conservation, 157, 187-195. doi:10.1016/j.biocon.2012.07.018

Squires, J. R., Ruggiero, L. F., Kolbe, J. A., & DeCesare, N. J. (2006). Lynx ecology in the intermountain West. Retrieved from Missoula, MT: http://www.rmrs.nau.edu/people/jsquires/index.shtml?awa=yes;

http://www.rmrs.nau.edu/publications/Lynx_Research_Program_Summary7_19_06_Final/Lynx_Research_Program_Summary7_19_06_Final.pdf

SRD-ACA. (2007). Status of the Whitebark pine (Pinus albicaulis) in Alberta. Retrieved from Edmonton, Alberta, Canada: http://aep.alberta.ca/fish-wildlife/species-at-risk/species-at-risk-publications-web-resources/plants/documents/SAR-StatusWhitebarkPineAlberta-Nov2007.pdf

Stansberry, B. J. (1991). Distribution, movements, and habitat use during spring, summer, and fall by mule deer in the north Salish Mountains, Montana. (Master of Science), Montana State University, Bozeman, MT.

Stark, N. M. (1989). The ecology of Vaccinium globulare: seedling establishment and nutrition. In: Wallace, Arthur; McArthur, E. Durant; Haferkamp, Marshall R., compilers. Proceedings--symposium on shrub ecophysiology and biotechnology; 1987 June 30 - July 2; Logan, UT. General Technical Report INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 164-168. Retrieved from Ogden, UT: http://www.biodiversitylibrary.org/bibliography/100070#/summary; http://dx.doi.org/10.5962/bhl.title.100070

Stebbins, R. C. (2003). A Field Guide to Western Reptiles and Amphibians (Peterson Field Guides) 3rd Edition. Boston - New York: Houghton Mifflin Company.

Steele, R. W., & Stark, N. (1977). Understory burning in larch/Douglas-fir forests as a management tool. Western Wildlands, 4(1), 25-29.

Steiger, E. M. (1980). Level I fire management analysis: the fire situation. Retrieved from Great Falls, MT:

Stephens, S. L., Moghaddas, J. J., Edminster, C., Fiedler, C. E., Haase, S., Harrington, M., . . . Youngblood, A. (2009). Fire treatment effects on vegetation structure, fuels, and potential fire severity in western US forests. Ecological Applications, 19(2), 305-320. doi:10.1890/07-1755.1

Stephens, S.L., Moghaddas, J.J., Edminster, C., Fiedler, C.E., Haase, S., Harrington, M., … & Youngblood, A. (2009). Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications, 19(2), 305-320.

Stephens, S.L., Moghaddas, J.J., Edminster, C., Fiedler, C.E., Haase, S., Harrington, M., … & Youngblood, A. (2009). Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications, 19(2), 305-320.

Stewart, B. P., Nelson, T. A., Laberee, K., Nielsen, S. E., Wulder, M. A., & Stenhouse, G. (2013). Quantifying grizzly bear selection of natural and anthropogenic edges. Journal of Wildlife Management, 77(5), 957-964. doi:10.1002/jwmg.535

Stewart, I. T. (2009). Changes in snowpack and snowmelt runoff for key mountain regions. Hydrological Processes, 23(1), 78-94. doi:10.1002/hyp.7128

Stewart, I. T., Cayan, D. R., & Dettinger, M. D. (2005). Changes toward earlier streamflow timing across western North America. Journal of Climate, 18(8), 1136-1155. doi:10.1175/Jcli3321.1

Stockmann, K., Anderson, N., Young, J., Skog, K., Healey, S., Loeffler, D., . . . Morrison, J. (2014). Estimates of carbon stored in harvested wood products from United States Forest Service

Northern Region, 1906-2012. Retrieved from Missoula, MT: http://www.treesearch.fs.fed.us/pubs/46647; http://www.fs.fed.us/rm/pubs_other/rmrs_2014_stockmann_k002.pdf

Strom, B. A., & Fule, P. Z. (2007). Pre-wildfire fuel treatments affect long-term ponderosa pine forest dynamics. International Journal of Wildland Fire, 16(1), 128-138. doi:10.1071/Wf06051

Sturdevant, N. (2016). [Personal communication between Nancy Sturdevant, Forest Service Entomologist and Heidi Trechsel, Forest Service Silviculturist].

Sutter, G. C. (1997). Nest-Site Selection and Nest-Entrance Orientation in Sprague's Pipit. The Wilson Bulletin, 109(3), 462-469.

Swank, W. T., Swift, J., L. W., & Douglass, I. E. (1988). Streamflow Changes Associated with Forest Cutting, Species Conversions, and Natural Disturbances. In W. T. Swank & D. A. Crossley Jr. (Eds.), Ecological Studies, Vol. 66: Forest Hydrology and Ecology at Coweeta (pp. 297-312). New York, NY: Springer-Verlag New York, Inc.

Swift Jr., L. W., & Burns, R. G. (1999). The three Rs of roads - Redesign - reconstruction - restoration. Journal of Forestry, 97(8), 40-44.

Taylor, K., Brummer, T., Taper, M. L., Wing, A., & Rew, L. J. (2012). Human-mediated long-distance dispersal: an empirical evaluation of seed dispersal by vehicles. Diversity and Distributions, 18(9), 942-951. doi:10.1111/j.1472-4642.2012.00926.x

Teisberg, J. E., Madel, M. J., Mace, R. D., Servheen, C. W., & Robbins, C. T. (2015). Diet Composition and Body Condition of Northern Continental Divide Grizzly Bears, Final Report, March 2015. Retrieved from No URL

Telfer, E. S. (1995). Moose range under presettlement fire cycles and forest management regimes in the boreal forest of western Canada. Alces, 31, 153-165.

Tewksbury, J. J., Garner, L., Garner, S., Lloyd, J. D., Saab, V., & Martin, T. E. (2006). Tests of landscape influence: Nest predation and brood parasitism in fragmented ecosystems. Ecology, 87(3), 759-768. doi:10.1890/04-1790

Tewksbury, J. J., Martin, T. E., Hejl, S. J., Redman, T. S., & Wheeler, J. E. (1999). Cowbirds in a western valley: Effects of landscape structure, vegetation, and host density. Studies in Avian Biology, 18, 23-33.

Thiel, R. P. (1985). Relationship between Road Densities and Wolf Habitat Suitability in Wisconsin. American Midland Naturalist, 113(2), 404-407.

Thomas, J. W. (1979). Wildlife Habitats in Managed Forests the Blue Mountains of Oregon and Washington. Washington, D.C.: Agriculture Handbook No. 553. U.S. Department of Agriculture, Forest Service.

Thomas, J. W., & Toweill, D. E. (1982). Elk of North America: ecology and management. Harrisburg, PA: Stackpole Books.

Thomas, R. B., & Megahan, W. F. (1998). Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon: A second opinion. Water Resources Research, 34(12), 3393-3403. doi:10.1029/98wr02500

Tobalske, B. W., Shearer, R. C., & Hutto, R. L. (1991). Bird populations in logged and unlogged western larch/Douglas-fir forest in northwestern Montana. Retrieved from Ogden, UT: http://www.treesearch.fs.fed.us/pubs/41404; http://www.fs.fed.us/rm/pubs_int/int_rp442.pdf

Tobalske, Bret W.; Shearer, Raymong C.; Hutto, Richard L. 1991. Bird populations in logged and unlogged western larch/Douglas-fir forest in northwestern Montana. Res. Pap. INT-442. Ogden, UT: USDA, Forest Service, Intermtn. For. And Range Exp. Sta. 12 p.

Tobalske, Bret W.; Shearer, Raymong C.; Hutto, Richard L. 1991. Bird populations in logged and unlogged western larch/Douglas-fir forest in northwestern Montana. Res. Pap. INT-442. Ogden, UT: USDA, Forest Service, Intermtn. For. And Range Exp. Sta. 12 p.

Todd-Brown, K. E. O., Randerson, J. T., Post, W. M., Hoffman, F. M., Tarnocai, C., Schuur, E. A. G., & Allison, S. D. (2013). Causes of variation in soil carbon simulations from CMIP5 earth system models and comparison with observations. Biogeosciences, 10(3), 1717-1736. doi:10.5194/bg-10-1717-2013

Tomback, D. F. (1982). Dispersal of whitebark pine seeds by Clark's nutcracker: a mutualism hypothesis. Journal of Animal Ecology, 51(2), 451-467. doi:10.2307/3976

Tomback, D. F. (1998). Clark's Nutcracker (Nucifraga columbiana), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online. Retrieved from http://bna.birds.cornell.edu/bna/species/331

Tomback, D. F., & Achuff, P. (2010). Blister rust and western forest biodiversity: ecology, values and outlook for white pines. Forest Pathology, 40(3-4), 186-225. doi:10.1111/j.1439-0329.2010.00655.x

Tomback, D. F., & Linhart, Y. B. (1990). The evolution of bird-dispersed pines. Evolutionary Ecology, 4(3), 185-219. doi:10.1007/Bf02214330

Tomback, D. F., Arno, S. F., & Keane, R. E. (2001). The compelling case for management intervention (Chapter 1). In D. F. Tomback, S. F. Arno, & R. E. Keane (Eds.), Whitebark Pine Communities: Ecology and Restoration (pp. 3-25). Washington D.C.: Island Press.

Tonina, D., Luce, C. H., Rieman, B., Buffington, J. M., Goodwin, P., Clayton, S. R., . . . Berenbrock, C. (2008). Hydrological response to timber harvest in northern Idaho: implications for channel scour and persistence of salmonids. Hydrological Processes, 22(17), 3223-3235. doi:10.1002/hyp.6918

Treanor, H. B., Giersch, J. J., Kappenman, K. M., Muhlfeld, C. C., & Webb, M. A. H. (2013). Thermal tolerance of meltwater stonefly Lednia tumana nymphs from an alpine stream in Waterton-Glacier International Peace Park, Montana, USA. Freshwater Science, 32(2), 597-605. doi:10.1899/12-100.1

Trombulak, S. C., & Frissell, C. A. (2000). Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology, 14(1), 18-30. doi:10.1046/j.1523-1739.2000.99084.x

Turner, M.G., D.C. Donato, W.H. Romme. (2012). Consequences of spatial heterogeneity for ecosystem services in changing forest landscapes: Priorities for future research. Landscape Ecology DOI 10.1007/s10980-012-8741-4.

Turner, M.G., D.C. Donato, W.H. Romme. (2012). Consequences of spatial heterogeneity for ecosystem services in changing forest landscapes: Priorities for future research. Landscape Ecology DOI 10.1007/s10980-012-8741-4.

Turnock, B., & Anderson, A. (2012). Northern bog lemming (Synaptomis borealis) survey of Northwest Montana. Retrieved from Kalispell, MT:

US Geological Survey, Gap Analysis Program (GAP). (2011). National Land Cover, version 2, August 2011. Accessed 15 January 2014: http://gapanlysis.usgs.gov.

USDA. (1983). Northern Region Guide. Retrieved from Missoula, MT: http://www.fs.usda.gov/main/r1/home

USDA. (1986). Flathead National Forest Management Plan. Retrieved from Kalispell, MT: http://www.fs.usda.gov/land/flathead/landmanagement; http://www.fs.usda.gov/main/flathead/landmanagement/planning; https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5357688.pdf

USDA. (1986). Helena National Forest Plan. Retrieved from Helena, MT: http://www.fs.usda.gov/main/helena/landmanagement/planning; http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5352772.pdf

USDA. (1986). Lewis and Clark National Forest Plan. Retrieved from http://www.fs.usda.gov/detail/lcnf/landmanagement/?cid=stelprdb5409100

USDA. (1986). The Lolo National Forest Plan. Retrieved from Missoula, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd477025.pdf

USDA. (1990). Silvics of North America, Volume 1, Conifers (Vol. 1). Washington, D.C.: U.S. Department of Agriculture, Forest Service.

USDA. (1993). Decision Memo, Nonsignificant Forest Plan Amendment for Implementation of an Integrated Pest Management Approach to Weed Management in The Bob Marshall Wilderness Complex. Flathead National Forest Plan Amendment No. 17, Helena National Forest Plan Amendment No. 6, Lewis And Clark National Forest Plan Amendment No. 11, Lolo National Forest Plan Amendment No. 17. Retrieved from Missoula, MT:

USDA. (1995). Inland Native Fish Strategy: Environmental Assessment. Retrieved from Coeur d' Alene, ID:

USDA. (1995). Inland Native Fish Strategy: Environmental Assessment - Decision Notice and Finding of No Significant Impact. Retrieved from http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_033158.pdf

USDA. (1997). Conservation strategy for Howellia aquatilis A. Gray. Retrieved from

USDA. (1997). Conservation Strategy for Howellia aquatilis. Appendix VV to Flathead Forest Plan. Retrieved from Kalispell, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5357688.pdf

USDA. (2001). Decision Notice, Noxious and Invasive Weed Control Environmental Assessment. Retrieved from Kalispell, MT:

USDA. (2001). Future Trends in Agricultural Trade. Retrieved from http://www.aphis.usda.gov/publications/aphis_general/content/printable_version/brotradi.pdf

USDA. (2001). National Forest System Road Management Strategy Environmental Assessment and Civil Rights Impact Analysis. Retrieved from Washington, D.C.: Citation only, no URL found

USDA. (2001). Noxious and Invasive Weed Control Environmental Assessment. Retrieved from Kalispell, MT:

USDA. (2004). Watershed Protection and Management; Forest Service Manual 2520 Online reference to Forest Service Manual (FSM) Directive Issuances, Series 2000 - National Forest Resource Management available at http://www.fs.fed.us/im/directives/dughtml/fsm_2000.html: U.S. Department of Agriculture, Forest Service.

USDA. (2006). Gallatin National Forest Travel Management Plan, Final Environmental Impact Statement and Record of Decision. Retrieved from Bozeman, MT: http://www.fs.usda.gov/main/custergallatin/landmanagement/planning; http://www.fs.usda.gov/detail/custergallatin/landmanagement/planning/?cid=stelprdb5130474

USDA. (2006). Winter Motorized Recreation Plan, Record of Decision. Retrieved from Kalispell, MT: http://merid.org/~/media/Files/Projects/FNF/Recreation/Amendment24Winter%20Motorized%20Rec%20Plan.pdf

USDA. (2007). Final Environmental Impact Statement, Kootenai National Forest Invasive Plant Management, Kootenai National Forest, Lincoln, Sanders, and Flathead Counties, Montana; Bonner and Boundary Counties, Idaho. Retrieved from Libby, MT: http://www.fs.usda.gov/project/?project=9851; http://www.fs.usda.gov/wps/portal/fsinternet/projects/kootenai/landmanagement/projects?archive=0&sortby=0

USDA. (2007). Kootenai National Forest Invasive Plant Management Final Environmental Impact Statement, Chapter 3 - Environmental Consequences. Retrieved from Libby, MT: http://www.fs.usda.gov/detail/kootenai/home/?cid=STELPRDB5200882; http://www.fs.usda.gov/main/kootenai/landmanagement/planning

USDA. (2007). Northern Rockies Lynx Management Direction: Final Environmental Impact Statement (Volumes 1 and 2). Retrieved from Missoula, MT: http://www.fs.fed.us/r1/planning/lynx.html; http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6IeDdGCqCPOBqwDLG-AAjgb6fh75uan6BdnZaY6OiooA1tkqlQ!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfMjAwMDAwMDBBODBPSEhWTjJNMDAwMDAwMDA!/?navtype=BROWSEBYSUBJECT&cid=stelprdb5160650&navid=160120000000000&pnavid=160000000000000&ss=1101&position=Not%20Yet%20Determined.Html&ttype=detail&pname=Region%201-%20Resource%20Management

USDA. (2007). Record of Decision, Integrated Weed Management on the Lolo National Forest Retrieved from Missoula, MT:

USDA. (2008). Flathead National Forest Preliminary Report of annual monitoring requirements (1998-2007 date). Draft. Retrieved from Kalispell, MT: No URL found

USDA. (2010). Kootenai Idaho Panhandle Zone (KIPZ) climate change report. Retrieved from Missoula, MT:

USDA. (2011). Sensitive species designation for Whitebark pine. Retrieved from Missoula, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5341386.pdf

USDA. (2011). USDA Forest Service, Region 1 Sensitive Species - Plants, Montana. Retrieved from Missoula, MT: http://www.fs.usda.gov/detail/r1/plants-animals/?cid=stelprdb5130525

USDA. (2011). Watershed Condition Framework, A Framework for Assessing and Tracking Changes to Watershed Condition. Retrieved from http://data.globalchange.gov/report/usfs-fs-977; http://www.fs.fed.us/sites/default/files/media/types/publication/field_pdf/Watershed_Condition_Framework.pdf

USDA. (2012). 36 CFR Part 219, Planning. Federal Register / Vol. 77, No. 68 / Monday, April 9, 2012 / Rules and Regulations. National Forest System Land Management Planning. Retrieved from http://cfr.regstoday.com/36cfr219.aspx, http://www.gpo.gov/fdsys/pkg/FR-2012-04-09/pdf/2012-7502.pdf

USDA. (2012). National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide. Retrieved from Washington, DC: http://www.fs.fed.us/sites/default/files/FS_National_Core_BMPs_April2012_sb.pdf

USDA. (2013). Final Environmental Impact Statement for the Revised Land Management Plan, Kootenai National Forest. Retrieved from Libby, MT: http://www.fs.usda.gov/main/kootenai/landmanagement/planning; http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5436479.pdf

USDA. (2013). Forest Service National Strategic Framework for Invasive Species Management. Retrieved from http://www.fs.fed.us/foresthealth/publications/Framework_for_Invasive_Species_FS-1017.pdf

USDA. (2013). Interagency Lynx Biology Team: Canada lynx conservation assessment and strategy, 3rd edition. Retrieved from Missoula, MT: http://www.fs.fed.us/biology/resources/pubs/wildlife/index.html; http://www.fs.fed.us/biology/resources/pubs/wildlife/LCAS_revisedAugust2013.pdf

USDA. (2013). Kootenai National Forest, Forest Plan Revision, Chapter II: Biological Opinion for Grizzly Bears. Retrieved from Eureka, MT:

USDA. (2013). Outstandingly Remarkable Values Assessment of the Flathead River System, Flathead National Forest, Glacier National Park. Retrieved from Kalispell, MT: Citation only, no URL found

USDA. (2013). Range Program Assessment, Flathead National Forest. Retrieved from

USDA. (2014). An assessment of fisher (Pekania pennanti) habitat in the U.S. Forest Service Northern Region. Retrieved from Missoula, MT: No URL found

USDA. (2014). Assessment of the Flathead National Forest, Part 1, Part 2, and Appendices A-E. Retrieved from Kalispell, MT: http://www.fs.usda.gov/detailfull/flathead/home/?cid=stelprdb5422786&width=full

USDA. (2014). Grazing Permit History on the Flathead National Forest, 1999-2014. Retrieved from Kalispell, MT: No URL link

USDA. (2015). Assessment of the Helena and Lewis & Clark National Forests. Retrieved from Helena, MT: http://www.fs.usda.gov/detailfull/helena/home/?cid=stelprd3798801&width=full; http://www.fs.usda.gov/detailfull/helena/home/?cid=stelprd3832458&width=full

USDA. (2015). Baseline Estimates of Carbon Stocks in Forests and Harvested Wood Products for National Forest System Units; Pacific Northwest Region. Retrieved from http://www.fs.fed.us/climatechange/documents/PacificNorthwestRegionCarbonAssessment.pdf

USDA. (2015). Errata for the 2013 Kootenai National Forest Land Management Plan. Retrieved from Missoula, MT: http://www.fs.usda.gov/main/kootenai/landmanagement/planning; http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3826664.pdf

USDA. (2015). Errata for the Final Environmental Impact Statement for the Kootenai National Forest Land Management Plan, Lincoln, Sanders, and Flathead Counties, Montana and Bonner and Boundary Counties, Idaho. Retrieved from Missoula, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3826662.pdf; http://www.fs.usda.gov/main/kootenai/landmanagement/planning

USDA. (2015). Final Record of Decision for the Final Environmental Impact Statement and Kootenai National Forest Land Management Plan, Lincoln, Sanders, and Flathead Counties, Montana and Bonner and Boundary Counties, Idaho. Retrieved from Missoula, MT: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3826661.pdf; http://www.fs.usda.gov/main/kootenai/landmanagement/planning

USDA. (2015). Fiscal Year 2015 Forest Legacy Program Proposed Projects. U.S. Department of Agriculture, Forest Service, Forest Legacy Program. Available online at http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml. Retrieved from http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml

USDA. (2015). Forest Service Handbook (FSH) 1909.12, Land Management Planning Handbook. Retrieved from http://www.fs.fed.us/im/directives/

USDA. (2015). Land Management Plan, 2015 Revision, Kootenai National Forest. Retrieved from Libby, MT: http://www.fs.usda.gov/main/kootenai/landmanagement/planning; http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3826663.pdf

USDA. 36 CFR Part 294 - Special Areas, Roadless Area Conservation Rule. Code of Federal Regulations. Retrieved from http://cfr.regstoday.com/36cfr294.aspx

USDA. Forest Service Manual and Handbooks. Retrieved from http://www.fs.fed.us/im/directives/

USDA. National Fire Plan Research. Retrieved from https://www.forestsandrangelands.gov/resources/overview/nfp_research.shtml

USDC_MT. (2010). Swan View Coalition and Friends of the Wild Swan, Plaintiffs, vs. Cathy Barbouletos, et al., Defendants. Retrieved from Missoula, MT: No URL found

USDI-BR. (1994). Montana Bald Eagle Management Plan, July 1994. Retrieved from Billings, MT: http://www.fws.gov/montanafieldoffice/Endangered_Species/Recovery_and_Mgmt_Plans/Montana_Bald_Eagle_mgmt_plan.pdf; http://www.fws.gov/montanafieldoffice/Endangered_Species/Recovery_and_Mgmt_Plans.html

US-EPA. (2014). Chapter 6: Land Use, Land-Use Change, and Forestry. Retrieved from https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html

USFWS (2009). Spalding's catchfly (Silene spaldingii) 5-Year Review: Short Form Summary. Boise, ID, U.S. Department of the Interior, Fish and Wildlife Service: 5.

USFWS (2009). Spalding's catchfly (Silene spaldingii) 5-Year Review: Short Form Summary. Boise, ID, U.S. Department of the Interior, Fish and Wildlife Service: 5.

USFWS 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; The Plant, Water Howellia (Howellia Aquatilis), Determined To Be a Threatened Species, Final Rule. Federal Register Vol. 59, No. 134 (Thursday, July 14, 1994), [FR DOC #94-17134], (1994).

USFWS 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule. Federal Register / Vol. 74, No. 36 / Wednesday, February 25, 2009 / Rules and Regulations/Pages 8615 - 8702 [FR DOC # E9-3512] (2009).

USFWS 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List Pinus albicaulis as Endangered or Threatened With Critical Habitat, Federal Register /Vol. 76, No. 138 /Tuesday, July 19, 2011 / Proposed Rules /Pages 42631 - 42654 [FR DOC # 2011-17943], (2011).

USFWS 50 CFR Part 17, Threatened Status for the Distinct Population Segment of the North American Wolverine occurring in the Contiguous United States. U.S. Department of the Interior, Fish and Wildlife Service. Proposed rules; withdrawal. Federal Register / Vol. 79, No. 156 / Wednesday, August 13, 2014 / Proposed Rules, 47522-47545, (2014).

USFWS. (1986). Recovery Plan for the Pacific Bald Eagle. Retrieved from Portland, OR: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3847245.pdf

USFWS. (1987). Northern Rocky Mountain Wolf Recovery Plan. Retrieved from Denver, CO: http://www.fws.gov/montanafieldoffice/Endangered_Species/Recovery_and_Mgmt_Plans/Northern_Rocky_Mountain_Gray_Wolf_Recovery_Plan.pdf

USFWS. (1993). Grizzly Bear Recovery Plan. Retrieved from Missoula, MT: http://www.fws.gov/montanafieldoffice/Endangered_Species/Recovery_and_Mgmt_Plans.html; http://www.nps.gov/noca/upload/Grizzly_bear_recovery_plan.pdf

USFWS. (1996). Water howellia (Howellia aquatilis) recovery plan, public and agency review draft. Report to the U.S. Fish and Wildlife Service. Retrieved from No URL found

USFWS. (1998). 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Final Rule. Federal Register /Vol. 63, No. 111 /Wednesday, June 10, 1998 /Rules and Regulations/Pages 31647 - 31674 (28 pages) [FR DOC #: 98-15319]. U.S. Department of the Interior, Fish and Wildlife Service Retrieved from https://www.federalregister.gov/; https://www.federalregister.gov/articles/1998/06/10; https://www.gpo.gov/fdsys/pkg/FR-1998-06-10/pdf/98-15319.pdf.

USFWS. (1999). 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Final Rule To Remove the American Peregrine Falcon From the Federal List of Endangered and Threatened Wildlife,

and To Remove the Similarity of Appearance Provision for Free-Flying Peregrines in the Conterminous United States Federal Register/ Vol. 64, No. 164/ Wednesday, August 25, 1999/ Rules and Regulations 46542-46558. U.S. Department of the Interior, Fish and Wildlife Service Retrieved from https://www.federalregister.gov/articles/1999/08/25/99-21959/endangered-and-threatened-wildlife-and-plants-final-rule-to-remove-the-american-peregrine-falcon.

USFWS. (2001). 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Final Rule To List Silene spaldingii (Spalding's Catchfly) as Threatened, Federal Register / Vol. 66, No. 196 / Wednesday, October 10, 2001 / Rules and Regulations / Pages 51598 - 51606 [FR DOC # 01-23912]. Washington, D.C.: U.S. Department of the Interior, Fish and Wildlife Service Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2001-10-10/pdf/01-23912.pdf; http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR; https://www.federalregister.gov/articles/2001/10/10/01-23912/endangered-and-threatened-wildlife-and-plants-final-rule-to-list-silene-spaldingii

USFWS. (2003). Post-Delisting Monitoring Results for the American Peregrine Falcon (Falco peregrinus anatum). Portland, OR: Federal Register Retrieved from http://www.fws.gov/mountain-prairie/species/birds/apfalcon/Monitoring%20Results%20for%20Breeding%20American%20Peregrine%20Falcons.pdf.

USFWS. (2005). Recovery Outline, Contiguous United States Distinct Population Segment of the Canada Lynx. Retrieved from Helena, MT:

USFWS. (2006). Biological Opinion on the Effects of the "Winter Motorized Recreation Forest Plan Amendment for the Flathead National Forest" ("A24") on Grizzly Bears. Retrieved from Helena, MT: No URL found

USFWS. (2007). Biological Opinion on the Northern Rockies Lynx Management Decision. Retrieved from No URL found

USFWS. (2007). National Bald Eagle Management Guidelines. Retrieved from https://www.fws.gov/southdakotafieldoffice/NationalBaldEagleManagementGuidelines.pdf

USFWS. (2007). Recovery Plan for Silene spaldingii (Spalding's Catchfly). Retrieved from Portland, OR: http://www.fws.gov/endangered/species/recovery-plans.html; http://ecos.fws.gov/docs/recovery_plan/071012.pdf

USFWS. (2011). Grizzly Bear (Ursus arctos horribilis) 5-Year Review: Summary and Evaluation. Retrieved from Missoula, MT: http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Final%205YearReview_August%202011.pdf

USFWS. (2011). Revised Biological Opinion on the Effects of the Final Access Management Strategy for the Swan Grizzly Bear Subunit on Grizzly Bears, Lolo National Forest. Retrieved from Helena, MT:

USFWS. (2013 (revised supplement to 1993)). Grizzly Bear Recovery Plan, Draft Revised Supplement: Revised Demographic Recovery Criteria for the Yellowstone Ecosystem (approved February 19, 2013). Retrieved from Missoula, MT: http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Grizzly_Bear_Recovery_Plan_March2013.pdf; http://www.nps.gov/noca/upload/Grizzly_bear_recovery_plan.pdf

USFWS. (2013). 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States. Federal Register / Vol. 78, No. 23 / Monday, February 4, 2013 / Proposed Rules/ Pages 7864-7890. U.S. Department of the Interior, Fish and Wildlife Service Retrieved from http://www.regulations.gov/; http://www.fws.gov/mountain-prairie/species/mammals/wolverine/; http://www.archives.gov/federal-register/cfr/about.html.

USFWS. (2013). Endangered and Threatened Wildlife and Plants; Draft Conservation Strategy for the Northern Continental Divide Ecosystem Grizzly Bear. Federal Register / Vol. 78, No. 86 / Friday, May 3, 2013 / Notices/ Page 26064. U.S. Department of the Interior, Fish and Wildlife Service Retrieved from http://www.fws.gov/endangered/species/recovery-plans.html.

USFWS. (2013). Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy Draft. Retrieved from http://www.fws.gov/mountain-prairie/species/mammals/grizzly/continentalindex.html; http://www.fws.gov/mountain-prairie/species/mammals/grizzly/NCDE_Draft_CS_Apr2013_Final_Version_corrected_headers.pdf

USFWS. (2013). Water howellia (Howellia aquatilis) 5-Year Review: Summary and Evaluation. Retrieved from Helena, MT: http://ecos.fws.gov/docs/five_year_review/doc4271.pdf

USFWS. (2014). Appendix III- News Release. Service Announces Draft Economic Analysis, Draft Environmental Assessment for Revised Canada Lynx Critical Habitat. Lakewood, CO: U.S. Fish and Wildlife Service, Mountain-Prairie Region, Office of External Affairs.

USFWS. (2014). Biological Opinion on the Effects of the Flathead National Forest Plan Amendment 19 Revised Implementation Schedule on Grizzly Bears. Retrieved from Helena, MT:

USFWS. (2014). Draft Environmental Assessment. Revised designation of critical habitat for the contiguous United States distinct population segment of the Canada Lynx. Retrieved from Denver, CO: http://www.fws.gov/mountain-prairie/species/mammals/lynx/

USFWS. (2014). Gray Wolves in the Northern Rocky Mountains. News, Information and Recovery Status Reports. Mountain-Prairie Region. Retrieved from http://www.fws.gov/mountain-prairie/species/mammals/wolf/

USFWS. (2015). Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus). Retrieved from Portland, OR: http://www.fws.gov/pacific/bulltrout/Planning.html; http://www.fws.gov/pacific/bulltrout/pdf/Final_Bull_Trout_Recovery_Plan_092915.pdf

USFWS. (2016). Threatened, endangered and candidate species for the Flathead National Forest, 1/20/2016. Retrieved from Helena, MT: http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/Forests/Flathead_sp_list.pdf

Van Wagtendonk, J. W. (2004). Fire and landscapes: patterns and processes. In D. D. Murphy & P. A. Stine (Eds.), Proceedings of the Sierra Nevada Science Symposium, General Technical Report PSW-193 (pp. 69-78). Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

van Wagtendonk, J.W. (2004). Fire and landscapes, patterns and processes. In: Sierra Nevada Science Symposium, Science for the Management and Conservation, October 7-10, 2002, Kings Beach,

CA (pp. 69-78). Gen. Tech. Rep. PSW-GTR-193. USDA Forest Service, Pacific Southwest Research Station.

van Wagtendonk, J.W. (2004). Fire and landscapes, patterns and processes. In: Sierra Nevada Science Symposium, Science for the Management and Conservation, October 7-10, 2002, Kings Beach, CA (pp. 69-78). Gen. Tech. Rep. PSW-GTR-193. USDA Forest Service, Pacific Southwest Research Station.

Vander Wall, S. B., & Hutchins, H. E. (1983). Dependence of Clark's Nutcracker, Nucifraga columbiana, on conifer seeds during postfledging period. Canadian Field Naturalist, 97(2), 208-214.

Vanderzanden, D., S. Brown, and R. Ahl. 2009. R10VMap Accuracy Assessment Procedures for Region 1. Region 1 Vegetation Classification, Mapping, Inventory, and Analysis Report. Numbered Report 09-11.

Vanderzanden, D., S. Brown, and R. Ahl. 2009. R10VMap Accuracy Assessment Procedures for Region 1. Region 1 Vegetation Classification, Mapping, Inventory, and Analysis Report. Numbered Report 09-11.

Varley, N. (1998). Winter Recreation and Human Disturbance on Mountain Goats: A Review. In: Northern Wild Sheep and Goat Proceedings 1998. Retrieved from Yellowstone National Park, WY: http://www.nwsgc.org/proceedings.html; http://www.nwsgc.org/contents/1998contents.html; http://media.nwsgc.org/proceedings/NWSGC-1998/1998-Varley.pdf

Vore, J. M., & Schmidt, E. M. (2001). Movements of female elk during calving season in northwest Montana. Wildlife Society Bulletin, 29(2), 720-725.

Vore, J. M., Hartman, T. L., & Wood, A. K. (2007). Elk habitat selection and winter range vegetation management in northwest Montana. Intermountain Journal of Sciences, 13, 86-97.

Wallace, A., McArthur, E. D., & Haferkamp, M. R. (1989). Proceedings - Symposium on shrub ecophysiology and biotechnology; 1987 June 30 - July 2. Retrieved from Ogden, UT: http://www.biodiversitylibrary.org/bibliography/100070#/summary; http://dx.doi.org/10.5962/bhl.title.100070

Waller, J. S., & Mace, R. D. (1997). Grizzly bear habitat selection in the Swan Mountains, Montana. Journal of Wildlife Management, 61(4), 1032-1039. doi:10.2307/3802100

Waller, J. S., & Miller, C. S. (2015). Decadal Growth of Traffic Volume on US Highway 2 in Northwestern Montana. Intermountain Journal of Sciences, 21(1-4), 29-37.

Waller, J. S., & Servheen, C. (2005). Effects of transportation infrastructure on grizzly bears in northwestern Montana. Journal of Wildlife Management, 69(3), 985-1000. doi:10.2193/0022-541x(2005)069[0985:Eotiog]2.0.Co;2

Wallmo, O. C., Gill, R. B., Carpenter, L. H., & Reichert, D. W. (1973). Accuracy of Field Estimates of Deer Food-Habits. Journal of Wildlife Management, 37(4), 556-562. doi:10.2307/3800322

Walters, C. J., & Holling, C. S. (1990). Large-scale management experiments and learning by doing. Ecology, 71(6), 2060-2068. doi:10.2307/1938620

Walther, G.-R., Post, E., Convey, P., Menzel, A., Parmesan, C., Beebee, T. J. C., . . . Bairlein, F. (2002). Ecological responses to recent climate change. Nature, 416(6879), 389-395. doi:10.1038/416389a

Warren, C. E., & Liss, W. J. (1980). Adaptation to Aquatic Environments, Chapter 2. In R. T. Lackey & L. A. Nielsen (Eds.), Fisheries Management (pp. 15-40). New York - Toronto: Halsted Press, John Wiley and Sons.

Warwell, M. V., Rehfeldt, G. E., & Crookston, N. L. (2007). Modeling contemporary climate profiles and predicting their response to global warming for whitebark pine (Pinus albicaulis). Oral presentation. Paper presented at the Proceedings of the Conference Whitebark Pine: A Pacific Coast Perspective (R6-NR-FHP-2007-01), 2006 August 27-31, Ashland, OR.

Wasserman, T. N., Cushman, S. A., Littell, J. S., Shirk, A. J., & Landguth, E. L. (2013). Population connectivity and genetic diversity of American marten (Martes americana) in the United States northern Rocky Mountains in a climate change context. Conservation Genetics, 14(2), 529-541. doi:10.1007/s10592-012-0336-z

Watson, A., Martin, S., Christensen, N., Fauth, G., & Williams, D. (2015). The Relationship Between Perceptions of Wilderness Character and Attitudes Toward Management Intervention to Adapt Biophysical Resources to a Changing Climate and Nature Restoration at Sequoia and Kings Canyon National Parks. Environmental Management, 56(3), 653-663. doi:10.1007/s00267-015-0519-8

Weaver, J. L. (2013). Safe havens, safe passages for vulnerable fish and wildlife: critical landscapes in the southern Canadian Rockies, British Columbia and Montana. Retrieved from Toronto, Ontario, Canada: http://crownmanagers.org/storage/Weaver2013_SCR_WCSweb.pdf

Weaver, J. L. (2014). Conservation Legacy on a Flagship Forest: Wildlife and Wildlands on the Flathead National Forest, Montana. Wildlife Conservation Society Working Paper No. 43. Retrieved from Bronx, New York, USA: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjI5LmQ19nKAhUK6mMKHeRNC38QFggcMAA&url=http%3A%2F%2Fwww.wcsnorthamerica.org%2FAdmin-Plus%2FDocustore%2FCommand%2FCore_Download%2FEntryId%2F28194.aspx&usg=AFQjCNFbCN6XJslT6iW_LSda_zKBLU1O8g&bvm=bv.113034660,d.cGc

Weaver, T. M. (1994). Fisheries monitoring on Swan River and Stillwater State Forests. Retrieved from Kalispell, MT: No URL found

Weaver, T. M. (1998). Fisheries monitoring on Swan River and Stillwater State Forests. Retrieved from Kalispell, MT: No URL found

Weaver, T. M., & Fraley, J. J. (1993). A Method to Measure Emergence Success of Westslope Cutthroat Trout Fry from Varying Substrate Compositions in a Natural Stream Channel. North American Journal of Fisheries Management, 13(4), 817-822. doi:10.1577/1548-8675(1993)013<0817:AMTMES>2.3.CO;2

Weekes, A. A., Torgersen, C. E., Montgomery, D. R., Woodward, A., & Bolton, S. M. (2012). A Process-Based Hierarchical Framework for Monitoring Glaciated Alpine Headwaters. Environmental Management, 50(6), 982-997. doi:10.1007/s00267-012-9957-8

Weigel, D. E., Peterson, J. T., & Spruell, P. (2003). Introgressive hybridization between native cutthroat trout and introduced rainbow trout. Ecological Applications, 13(1), 38-50. doi:10.1890/1051-0761(2003)013[0038:Ihbnct]2.0.Co;2

Wemple, B. C., Swanson, F. J., & Jones, J. A. (2001). Forest roads and geomorphic process interactions, Cascade Range, Oregon. Earth Surface Processes and Landforms, 26(2), 191-204. doi:10.1002/1096-9837(200102)26:2<191::Aid-Esp175>3.0.Co;2-U

Wenger, S. J., Isaak, D. J., Dunham, J. B., Fausch, K. D., Luce, C. H., Neville, H. M., . . . Chandler, G. L. (2011). Role of climate and invasive species in structuring trout distributions in the interior Columbia River Basin, USA. Canadian Journal of Fisheries and Aquatic Sciences, 68(6), 988-1008. doi:10.1139/F2011-034

Westerling, A. L., & Bryant, B. P. (2008). Climate change and wildfire in California. Climatic Change, 87, S231-S249. doi:10.1007/s10584-007-9363-z

Westerling, A. L., Hidalgo, H. G., Cayan, D. R., & Swetnam, T. W. (2006). Warming and earlier spring increase western U.S. forest wildfire activity. Science, 313(5789), 940-943. doi:10.1126/science.1128834

Westerling, A.L. and B.P. Bryant. 2008. Climate change and wildfire in California. Climatic Change: 87(Suppl. 1): S231-S249.

Westerling, A.L. and B.P. Bryant. 2008. Climate change and wildfire in California. Climatic Change: 87(Suppl. 1): S231-S249.

White, C. M., Clum, N. J., Cade, T. J., & Hunt, W. G. (2002). Peregrine Falcon (Falco peregrinus), The Birds of North America Online (A. Poole, Ed.). Ithaca, NY. Cornell Lab of Ornithology. Retrieved from http://bna.birds.cornell.edu/bna/species/660

White, C. M., McLaren, M. F., Van Lanen, N. J., Pavlacky Jr., D. C., Blakesley, J. A., Sparks, R. A., . . . Hanni, D. J. (2015). Integrated Monitoring in Bird Conservation Regions (IMBCR): 2014 Field Season Report. Retrieved from Brighton, CO, USA: http://www.birdconservancy.org/what-we-do/science/monitoring/imbcr-program/; http://www.birdconservancy.org/wp-content/uploads/2015/10/2014_IMBCR_report.pdf

Whittington, J., St Clair, C. C., & Mercer, G. (2005). Spatial responses of wolves to roads and trails in mountain valleys. Ecological Applications, 15(2), 543-553. doi:10.1890/03-5317

Wiggins, D. A. (2005). Harlequin Duck (Histrionicus histrionicus): A Technical Conservation Assessment. Retrieved from http://www.fs.fed.us/r2/projects/scp/assessments/harlequinduck.pdf; http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182003.pdf

Williams, J. E., Williams, R. N., Thurow, R. F., Elwell, L., Philipp, D. P., Harris, F. A., . . . Sedell, J. R. (2011). Native Fish Conservation Areas: A Vision for Large-Scale Conservation of Native Fish Communities. Fisheries, 36(6), 267-277. doi:10.1080/03632415.2011.582398

Williams, J. E., Wood, C. A., & Dombeck, M. P. (1997). Watershed Restoration: Principles and Practices: American Fisheries Society.

Wilson, S. F., & Shackleton, D. M. (2001). Backcountry Recreation and Mountain Goats: A Proposed Research and Adaptive Management Plan. Retrieved from Victoria BC: http://www.env.gov.bc.ca/wld/documents/techpub/b103.pdf

Wilson, S. M., Madel, M. J., Mattson, D. J., Graham, J. M., Burchfiled, J. A., & Belsky, J. M. (2005). Natural landscape features, human-related attractants, and conflict hotspots: a spatial analysis of

human-grizzly bear conflicts. Ursus, 16(1), 117-129. doi:http://dx.doi.org/10.2192/1537-6176(2005)016[0117:NLFHAA]2.0.CO;2

Wisdom, M. J., & Bate, L. J. (2008). Snag density varies with intensity of timber harvest and human access. Forest Ecology and Management, 255(7), 2085-2093. doi:10.1016/j.foreco.2007.12.027

Wisdom, M. J., Holthausen, R. S., Wales, B. C., Hargis, C. D., Saab, V. A., Lee, D. C., . . . Eames, M. R. (2000). Source habitats for terrestrial vertebrates of focus in the interior Columbia Basin: broadscale trends and management implications. Volume 1 - Overview, General Technical Report PNW-485. Retrieved from Portland, OR: http://www.treesearch.fs.fed.us/pubs/3081; http://www.fs.fed.us/pnw/pubs/gtr485/; http://www.fs.fed.us/pnw/pubs/gtr485/gtr485v1.pdf

Witt, E. L., Barton, C. D., Stringer, J. W., Kolka, R. K., & Cherry, M. A. (2016). Influence of Variable Streamside Management Zone Configurations on Water Qualily after Forest Harvest. Journal of Forestry, 114(1), 41-51. doi:10.5849/jof.14-099

Wondzell, S. M. (2001). The influence of forest health and protection treatments on erosion and stream sedimentation in forested watersheds of eastern Oregon and Washington. Northwest Science, 75, 128-140.

Woodall, C., Smith, J., & Nichols, M. (2013). Data sources and estimation/modeling procedures for National Forest System carbon stocks and stock change estimates derived from the US National Greenhouse Gas Inventory. Retrieved from http://www.fs.fed.us/climatechange/documents/NFSCarbonMethodology.pdf

Woods, T., Morey, S., & Mitchell, M. (2014). Wolverine Science Panel Workshop. Retrieved from Spokane, WA: http://www.fws.gov/mountain-prairie/science/PeerReviewDocs/Final_Wolverine_Panel_Report.pdf

WPEC. (2008). Threats - Why we are concerned about the future of whitebark pine. Online report at http://whitebarkfound.org/?page_id=52. Retrieved from http://whitebarkfound.org/?page_id=52

WRCC. (2015). Climate of Montana. Western Regional Climate Center (WRCC). Retrieved from http://www.wrcc.dri.edu/narratives/montana/

Wright, J. W. (1976). Introduction to forest genetics. New York: Academic Press.

Wright, V. (1996). Multi-Scale Analysis of Flammulated Owl Habitat Use: Owl Distribution, Habitat Management, and Conservation. (Master of Science), University of Montana, Missoula, Montana.

WSWG. (2012). Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat, Wild Sheep Working Group (WSWG). Retrieved from http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5385708.pdf

Wu, H., Kimball, J. S., Elsner, M. M., Mantua, N., Adler, R. F., & Stanford, J. (2012). Projected climate change impacts on the hydrology and temperature of Pacific Northwest rivers. Water Resources Research, 48. doi:10.1029/2012wr012082

Youmans, H. B. (1979). Habitat use by mule deer of the Armstrong Winter Range, Bridger Mountains, Montana. (Master of Science), Montana State University, Bozeman, MT. Retrieved from http://scholarworks.montana.edu/xmlui/bitstream/handle/1/6423/31762100227329.pdf?sequence=1

Young, M. K. (1995). Conservation assessment for inland cutthroat trout. Retrieved from Fort Collins, CO: http://www.treesearch.fs.fed.us/pubs/31928; http://www.fs.fed.us/rm/pubs_rm/rm_gtr256.pdf

Yount, J. D., & Niemi, G. J. (1990). Recovery of Lotic Communities and Ecosystems from Disturbance - a Narrative Review of Case Studies. Environmental Management, 14(5), 547-569. doi:10.1007/Bf02394709

Ziesak, R. (2015). Montana Forestry Best Management Practices Monitoring - 2014 Forestry BMP Field Review Report. Retrieved from Missoula, MT: http://dnrc.mt.gov/divisions/forestry/docs/assistance/practices/2012bmplongrpt.pdf

Zouhar, K., Kapler Smith, J., Sutherland, S., & Brooks, M. L. (2008). Wildland fire in ecosystems: Fire and nonnative invasive plants (9780160814655016081465 0). Retrieved from Fort Collins, CO: http://www.fs.fed.us/rm/pubs/rmrs_gtr042_6.pdf

Zubik, R. J., & Fraley, J. J. (1987). Determination of fishery losses in the Flathead system resulting from the construction of Hungry Horse Dam: final completion report 1986. Prepared for Bonneville Power Administration. Portland, OR: Montana Department of Fish, Wildlife and Parks.

Zwickel, F. C., & Bendell, J. F. (2005). Blue Grouse (Dendragapus obscurus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Retrieved from http://bna.birds.cornell.edu/bna/species/015.

Index

aquatic habitat, 120, 142

bull trout, 57

critical habitat, 210
culvert, 42, 44, 139

fen, 90, 91, 93, 95, 96
fire
  prescribed fire, 68, 69, 78, 84, 100, 146, 154, 155, 160, 166, 209, 211, 214
  wildfire, 25, 68, 69, 102, 105, 122, 128, 129, 154, 155, 160, 211, 214
fire management, 69, 102, 129, 154, 155, 160, 217

grizzly bear habitat, 16, 40, 78, 120, 127, 153, 155, 167, 168, 175, 176, 177, 210, 212, 215

habitat connectivity, 56

invasive species, 95, 96, 153, 157
  weeds, 57, 70, 85, 96, 102, 152, 153, 157
inventoried roadless areas, v, 3, 7, 60, 61, 62, 64, 65, 67, 68, 72, 73, 74, 75, 76, 77, 78, 79, 80, 107, 108, 111, 112, 113, 120, 121, 122, 140

livestock grazing, vi, 144, 145, 147, 148, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 165, 210, 211, 212, 214

motorized over-snow vehicle use, iv, 5, 14, 15, 16, 19, 21, 22, 23, 37, 58, 61, 63, 64, 65, 66, 67, 69, 71, 77, 78, 88, 89, 156

old growth, 179

peatland, 91, 92

recreation
  developed, iv, 7, 8, 9, 11, 15, 16, 17, 18, 26, 52, 69, 84, 212
  dispersed, 11, 15, 17, 18, 20, 25, 26, 37, 74
riparian
  area, 99, 107, 111, 120, 152, 153, 202, 211, 214
  habitat, 94, 142
  riparian management zone (RMZ), 90, 142
roads
  construction, 24, 32, 33, 34, 43, 69, 72, 76, 77, 78, 139, 142
  temporary, 42

scenic integrity, iv, 27, 28, 31, 32, 33, 34, 35, 74, 203

water howellia, 91, 92, 94
watersheds, 80, 120, 200, 209
wetland, 29, 91, 92, 93, 95, 99, 153, 158
whitebark pine, 29, 68, 69, 75, 76, 99
wildland urban interface, 70, 80, 96, 154

Page Intentionally Blank