United States
Department of
Agriculture

Forest Service
Southern Region

Final Environmental Impact Statement for the Revised Land and Resource Management Plan

Sumter National Forest

Management Bulletin R8-MB 116B

January 2004

The picnic shelter on the cover was originally named the Charles Suber Recreational Unit and was planned in 1936. The lake and picnic area including a shelter were built in 1938-1939. The original shelter was found inadequate and a modified model B-3500 shelter was constructed probably by the CCC from camp F-6 in 1941. The name of the recreation area was changed in 1956 to Molly's Rock Picnic Area, which was the local unofficial name. The name originates from a sheltered place between and under two huge boulders once inhabited by an African-American woman named Molly.

Final Environmental Impact Statement for the Revised Land and Resource Management Plan

SUMTER NATIONAL FOREST

Oconee, Chester, Fairfield, Laurens, Newberry, Union, Abbeville, Edgefield, Greenwood, McCormick and Saluda Counties in South Carolina

Responsible agency: USDA – Forest Service

Responsible official: Robert T. Jacobs
USDA – Forest Service, Southern Region
1720 Peachtree Road NW
Atlanta, GA 33067-9102

For Information contact: Jerome Thomas, Forest Supervisor
Francis Marion and Sumter National Forests
4931 Broad River Road
Columbia, South Carolina 29210-4021

Telephone (803) 561-4000

Abstract:

Nine alternatives for the revision of the *Land and Resource Management Plan* are described and compared. **A** - would emphasize production of goods and services beneficial to local economies and communities. **B** - would be biologically driven, emphasize restoring the natural resources and processes, and emphasize creating and maintaining wildlife habitats. **C** - was not developed in detail. Alternative C—commonly known as the zero timber cut alternative—did not need to be further evaluated in detail in the FEIS. **D** - would emphasize reaching and maintaining a balanced age class. This "balance of age classes" would occur on lands identified as suitable for timber harvest. **E** -dispersed and developed recreational areas and opportunities would be increased in this alternative. **F -** is the "No Action Alternative" (Current Management). This is the management under the existing 1985 Forest Plan, as amended. **G -** would emphasizes wilderness. Semi-primitive, wildlife, and nature-oriented recreational opportunities would be emphasized. **H** - was not developed in detail. When the management prescriptions applicable to this alternative were allocated, there was virtually no difference between this alternative and Alternative G. **I -** emphasizes management of forest ecosystems through restoration and maintenance, which ensures healthy watersheds; provides for sustainable and diverse ecosystems that support viable plant, wildlife, and fish populations; and provides for high quality, nature-based recreation opportunities, especially in non-motorized settings with high quality landscapes. **Alternative I is the alternative selected by the Forest Service.**

TABLE OF CONTENTS

Page

CHAPTER 1 – Purpose and Need

CHAPTER 2 – Alternatives

Page

CHAPTER 3 – Affected Environment and Environmental Consequences

Page

Page

CHAPTER 1

PURPOSE AND NEED

PROPOSED ACTION

The purpose of this proposed action is to revise the Sumter Land and Resource Management Plan (LMP). The revised LMP guides all natural resource management activities on the Sumter National Forest (SNF) to meet the objective of Federal law, regulations, and policy. The proposed action would also affect a wide range of socioeconomic factors as they relate to natural resources. The existing LMP for the SNF was approved August 1985. As of November 1, 2002, there are 14 amendments to the existing LMP. Revision of the LMP is now needed to satisfy regulation requirements and to address new information about the forest and its uses.

The regulations implementing the National Forest Management Act (NFMA) instruct the Regional Forester to make periodic revisions to LMP and to provide the basis for any revision. The instructions to revise forest plans, the basis for revision, are found in Code of Federal Regulations (CFR) 36 CFR 219.10(g).

The Final Environmental Impact Statement (FEIS) describes the analysis of several alternatives for revising the LMP of the SNF and discloses the environmental effects of the alternatives. The FEIS is guided by the implementing regulations of the National Environmental Policy Act (NEPA) found in the Council of Environmental Quality (CEQ) Regulations, Title 40, CFR, Part 1500. The companion document to this FEIS is the Revised Land and Resource Management Plan (RLMP)—a detailed presentation of the preferred alternative.

FOREST PLAN DECISIONS

National Forest System resource allocation and management decisions are made in two stages. The first stage is the LMP level decisions, which allocates lands and resources to various uses or conditions by establishing management areas and management prescriptions for the land and resources within the plan area. The second stage is approval of project level decisions.

Land and Resource Management Plans do not compel the agency to undertake any site-specific projects; rather, plans establish overall goals and objectives (or desired resource conditions) that the individual national forest strives to meet. Land and Resource Management Plans also establish limitations on what actions would be authorized, and what conditions would be met, during project level decision.

The primary decisions made in a LMP include:

1. Establishment of the forestwide multiple-use goals and objectives (36 CFR 219.11(b)).

2. Establishment of forestwide management requirements (36 CFR 219.13 to 219.27).

3. Establishment of multiple-use prescriptions and associated standards for each management area (36 CFR 219.11(c)).

4. Determination of land that is suitable for the production of timber (16 U.S.C. 1604(k) and 36 CFR 219.14).

5. Establishment of allowable sale quantity for timber within a time frame specified in the plan (36 CFR 219.16).

6. Establishment of monitoring and evaluation requirements (36 CFR 219.11(d)).

7. Recommendation of roadless areas as potential wilderness areas (36 CFR 219.17).

8. Where applicable, designation of lands administratively available for oil and gas leasing; and when appropriate, authorization of the Bureau of Land Management to offer specific lands for leasing (36 CFR 228.102 (d) and (e)).

The authorization of site-specific activities within a plan area occurs through project decision making, which is the implementation stage of forest planning. Project level decision requires compliance with NEPA procedures and a determination that the project is consistent with the LMP.

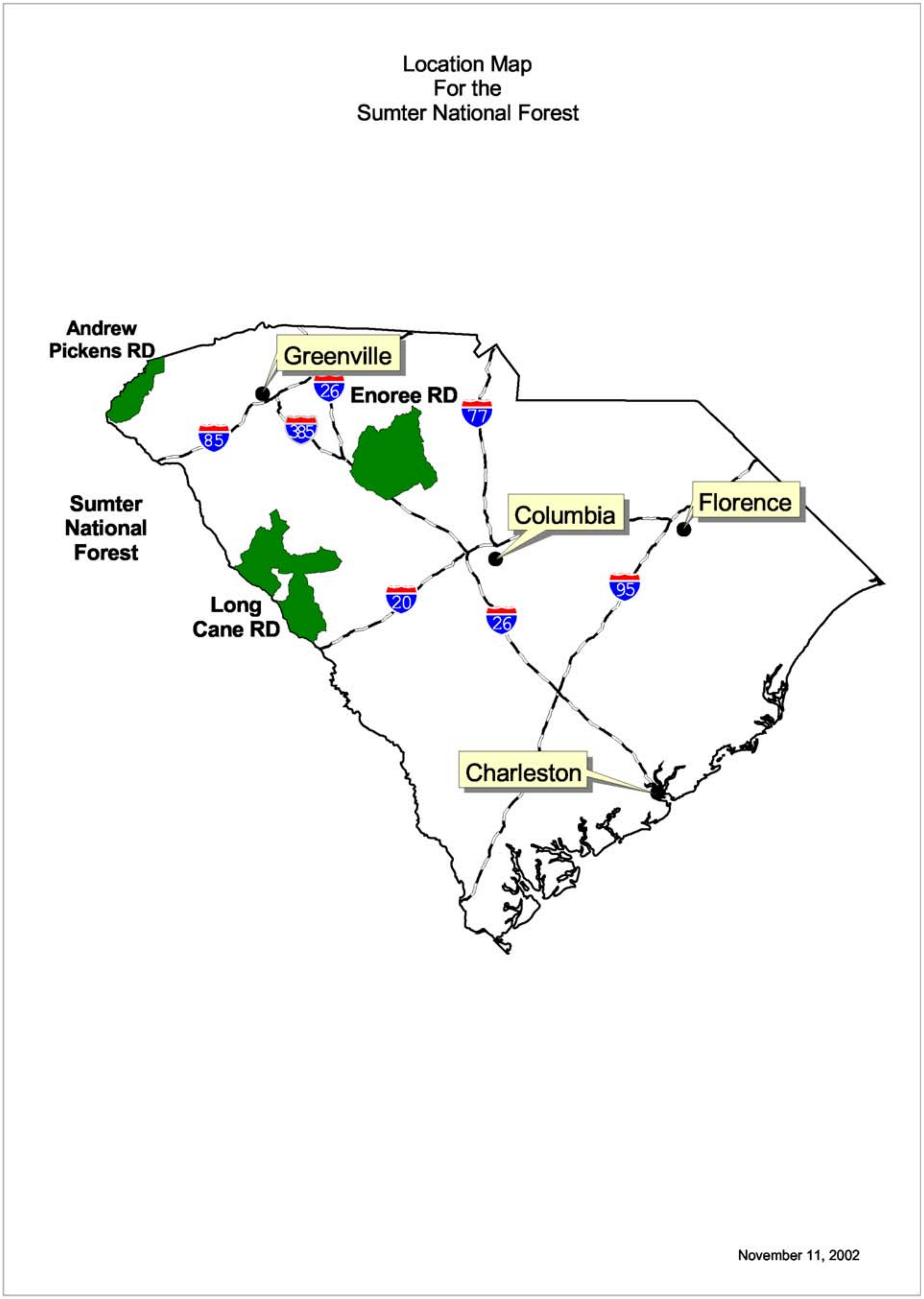
The following Environmental Impact Statements contain environmental analyses that are not repeated in this EIS, but provide supporting documentation for some of the forest plan decisions.

- *Final Environmental Impact Statement for Gypsy Moth Management in the United States: A Cooperative Approach* (USDA, Forest Service and APHIS, Washington DC, November 1995)

- *Final Environmental Impact Statement for the Management of the Red-cockaded Woodpecker and its Habitat on National Forests in the Southern Region* (RCW EIS) (USDA Forest Service, Southern Region, June 1995)
- *Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle* (USDA Forest Service, Southern Region, February 1987)
- *Final Environmental Impact Statement for Vegetation Management in the Appalachian Mountains* (USDA Forest Service, Southern Region, July 1989)
- *Final Environmental Impact Statement for Vegetation Management in the Coastal Plain/Piedmont* (USDA Forest Service, Southern Region, January 1989)
- *Final Environmental Impact Statement for Forest Service Roadless Area Conservation* (USDA Forest Service, Washington Office, November 2000)

FOREST PROFILE

The Sumter National Forest includes approximately 362,000 acres of National Forest System land in the mountains and piedmont of South Carolina. The forest is divided into three ranger districts located in 11 counties. The Andrew Pickens District is located in western Oconee County. The Enoree District is located east of Interstate 26 in Chester, Fairfield, Laurens, Newberry, and Union Counties. The Lone Cane District lies east of J. Strom Thurmond Lake in Abbeville, Edgefield, Greenwood, McCormick, and Saluda Counties.


Location Map
For the
Sumter National Forest
Andrew
Pickens RD
Greenville
26
Enoree RD
77
85
385
Sumter
National
Forest
Columbia
Florence
20
26
95
Long
Cane RD
Charleston
November 11, 2002

REASON FOR REVISION

The need to revise these plans is driven by the changing conditions identified in the Southern Appalachian Assessment (SAA) and in individual forest assessments, as well as the changing public values associated with these national forests. These conditions and values make it appropriate that all of these Southern Appalachian Forest Plan revisions (the Chatahooche-Oconee, Alabama, Cherokee, Sumter and Jefferson National Forests) be done simultaneously. The Forest and Rangeland Renewable Resources Planning Act (RPA), as amended by the National Forest Management Act of 1976 (NFMA), requires that each national forest be managed under a forest plan. The purpose of a forest plan is to provide an integrated framework for analyzing and approving future site-specific projects and programs. Regulations require that forest plans be revised on a 10-to-15-year cycle, or sooner if conditions or the areas covered by the plan change significantly.

Information from the previous analyses and efforts of the individual national forests to update their Analysis of the Management Situation (AMS) were used by the national forests to determine what decisions should be reanalyzed or changed in LMP revision. The main objective of the AMS has been to do the analysis leading to a proposal to change forest management direction. A draft AMS was completed for the Sumter National Forest in August 1996.

PLANNING PROCESS

Forest planning occurs within the overall framework provided by implementing the regulations of NFMA and NEPA. National, regional, and forest planning form an integrated three-level process. This process requires a continuous flow of information and management direction among three Forest Service administrative levels. Information from forest planning flows upward to the national level for use in the RPA program where, in turn, information flows back to the forest level. In this structure, regional planning is the principal process for conveying information between forest and national levels.

Planning actions required by the NFMA and used in this planning process are:

1. Identification of issues, concerns, and opportunities.
2. Development of planning criteria.
3. Inventory of resources and data collection.
4. Analysis of the Management Situation.
5. Formulation of alternatives.
6. Estimation of effects of alternatives.

7. Evaluation of alternatives.
8. Recommendation of preferred alternative.
9. Approval and implementation.
10. Monitoring and evaluation.

The results of planning steps 1-8 are described in this document. Refer to appendix A, “Summary of Public Involvement” and appendix B, “Analysis Process,” for more detail on the results of these steps.

PUBLIC INVOLVEMENT

Public involvement is a key part of the planning process. Providing for public comment helps identify what people want from the national forests in the form of goods, services, and environmental conditions. Issues submitted by the public, as well as from within the Forest Service, guided the need to change current management strategies. Some of the issues listed below were obtained from appeals of the forest plans. The public also submitted issues during public involvement efforts conducted by Forest Service personnel during the past 7 years.

In addition to the emerging issues, the need for change was identified through the Analysis of the Management Situation. This analysis also provides a basis for formulating a broad range of reasonable alternatives. A detailed account of the public involvement process is in appendix A, “Summary of Public Involvement.”

SIGNIFICANT ISSUES

The following issues and planning questions were used to develop alternatives for the forest plan revision process. The first twelve issues are common to the five national forests in the Southern Appalachian area that are working together through the revision process. The last two issues are local issues developed for the Sumter National Forest.

Issues–Southern Appalachian National Forests

1. **Terrestrial Plants and Animals and Their Associated Habitats:** How should the national forests retain/restore a diverse mix of terrestrial plant and animal habitat conditions while meeting public demands for a variety of wildlife values and uses?

2. **Threatened, Endangered, and Sensitive/Locally Rare Species:** What levels of management are needed to protect and recover the populations of federally listed threatened, endangered, and proposed species? What level of management is needed for Forest Service sensitive and locally rare species?

3. **Old Growth:** The issue surrounding old growth has several facets, including: (1) How much old growth is desired, (2) where should old growth occur, and (3) how should old growth be managed?

4. **Riparian Area Management, Water Quality, and Aquatic Habitats:** What are the desired riparian ecosystem conditions within national forests, and how will they be identified, maintained, and/or restored? What management direction is needed to help ensure that the hydrologic conditions needed for the beneficial uses of water yielded by and flowing through National Forest System lands are attained? What management is needed for the maintenance, enhancement, or restoration of aquatic habitats?

5. **Wood Products:** The issue surrounding the sustained yield production of wood products from national forests has several facets, including: What are the appropriate objectives for wood product management? Where should removal of products occur, given that this production is part of a set of multiple-use objectives and considering cost effectiveness? What should be the level of outputs of wood products? What management activities associated with the production of wood products are appropriate?

6. **Aesthetic/Scenery Management:** The issue surrounding the management of visual quality has two facets: What are the appropriate landscape character goals for the national forests? What should be the scenic integrity objectives for the national forests?

7. **Recreation Opportunities/Experiences**: How should the increasing demand for recreational opportunities and experiences be addressed on the national forests while protecting forest resources? Should the forests restrict equestrian use to designated routes only? This includes considering a full range of opportunities for developed and dispersed recreation activities (including such things as nature study, hunting and fishing activities, and trail uses).

8. **Roadless Areas/Wilderness Management:** Should any of the roadless areas on National Forest System lands be recommended for wilderness designation? For

any roadless areas not recommended for wilderness, how should they be managed? How should areas recommended for wilderness designation be managed? How should the patterns and intensity of use, fire, and insects and diseases be managed in the existing wilderness areas?

9. **Forest Health:** What conditions are needed to maintain the ability of the forests to function in a sustainable manner as expected or desired? Of particular concern are the impacts of exotic or non-native species and the presence of ecological conditions with a higher level of insect and disease susceptibility.

10. **Special Areas and Rare Communities:** What special areas should be designated, and how should they be managed? How should rare communities, such as those identified in the Southern Appalachian Assessment, be managed?

11. **Wild and Scenic Rivers:** Which rivers are suitable for designation into the National Wild and Scenic River System, and how should rivers that are eligible, but not suitable, be managed?

12. **Access/Road Management:** How do we balance the rights of citizens to access their national forests with our responsibilities to protect and manage the soil and water resources, wildlife populations and habitat, aesthetics, forest health, and desired vegetative conditions?

Issues–Sumter National Forest

13. **Chattooga River Watershed:** How can the national forest manage the Chattooga River watershed for desired social and ecological benefits while protecting the outstanding values of the Chattooga Wild and Scenic River corridor? Should the river be open or closed to public boating above Highway 28?

14. **Minerals:** What type of restrictions should we place on mineral development?

PLANNING PROCESS RECORDS

The SNF Interdisciplinary Team is responsible for developing the revised forest plan. Efforts were made to provide detailed explanations of each step of the revision in the form of process (or planning) records. This DEIS contains summaries of the process records and includes references to the parent records. Process records are on file in the Forest Supervisor's Office. To review these records, contact:

Forest Supervisor's Office
4931 Broad River Road
Columbia, SC 29212
Telephone: 803-561-4000

CHAPTER 2

ALTERNATIVES

INTRODUCTION

This chapter summarizes and compares the alternatives that were developed as potential management strategies for the Sumter National Forest. It explains the alternative development process, provides reasons why some of these alternatives were later eliminated from detailed study, describes the alternatives that are considered in detail, and lastly, compares how the alternatives respond to the significant issues identified in Chapter 1.

CONSISTENCY ACROSS FORESTS/STATE LINES

In an effort to have a consistent approach to the development of revised forest plans across the Southern Appalachian forests, various teams were assembled and actions taken. In addition to the individual Forest Interdisciplinary Teams (IDTs), the following teams comprised of individuals from the five forests worked on coordinating, developing, and analyzing the forest plan alternatives:

- The Steering Team is comprised of the Forest Supervisors of the five national forests and the Director of Planning. They provided oversight and direction to the overall planning effort.

- The SAP (Southern Appalachian Planners) Team included the Forest Planners from the five national forests and the Regional Planners. This group held numerous meetings, most open to the public, to develop and implement a coordinated approach to developing and analyzing the alternatives.

- The FWRBE (Fisheries, Wildlife, Range, Botany, and Ecology) Team was comprised of various specialists (wildlife, fisheries, etc.) from the forests and the region. This team developed a consistent approach to addressing those issues relating to terrestrial and aquatic species and their habitats including threatened, endangered, and sensitive species; species of viability concern; and rare communities. Most of these meetings were also open to the public.

- The SARRWAG (Southern Appalachian Recreation, Rivers, Wilderness Advisory Group) included recreation specialists from the forests and the region and developed a consistent approach to addressing recreation-related issues, evaluating roadless areas, managing wildernesses, studying wild and scenic rivers, and where applicable – management of the Appalachian Trail.

- The Riparian Team, comprised of hydrologists, soil scientists, and aquatic biologists, worked on developing a consistent approach to addressing water-and riparian-related issues.

In addition to the team efforts described above, some specific actions were taken to achieve a consistent approach to the planning process. They include, for the five forests:

- Working on the same schedule/timeline, starting with the issuance of a Notice of Intent to revise the forest plans for the five forests (on August 2, 1996), continuing on through the publication of these Final Environmental Impact Statements, and eventually will include the publication of the Final Environmental Impact Statements.

- Developing a common set of significant issues, which are described in Chapter 1.

- Developing a common set of management prescriptions. A team of representatives from the five forests and the regional office held a series of meetings, some of which were open to the public, to develop a common set of "generic" management prescriptions. First, different "categories" of prescriptions were identified and then "emphasis" statements were developed to address the various issues. Descriptions of the "desired conditions" that would result from implementing the management prescriptions were then developed. Later, the Forest IDTs took these "generic" descriptions of the management prescriptions and "localized" them to meet local conditions. The management prescriptions used on the Sumter National Forest are listed in Table 2-1.

- Coordinating an approach to development of the alternatives, described below.

ALTERNATIVE DEVELOPMENT

The alternative development process consisted of four different phases. The process involved a coordinated effort of the staffs of the five national forests of the Southern Appalachian area, with frequent meetings that were open to the public.

Phase I identified different ways the significant issues could be addressed.

Phase II developed four alternative themes using the information developed in Phase I. These alternative themes were the "starting points" for developing alternatives. The four themes are:

A. Produce high levels of goods and services compatible with local economies and communities.
B. Priority is given to restoring natural resources and processes.
C. Nature operates in conjunction with minimal human intervention.
D. Provide vigorously growing trees, commercial wood products, and a variety of wildlife habitats in a generally naturally-appearing setting.

Phase III involved mapping the four alternative themes and "current direction." The Phase III maps presented the land allocations, with each allocation consisting of a management emphasis, desired condition, and applicable management direction.

The objectives of Phase IV of the alternative development process were to analyze the four alternative themes to determine whether modifications were needed, whether other alternatives needed to be developed, and whether there were any areas of consensus. Public participation in both Phases III and IV was extensive and critically important to the overall process of developing alternatives. A description of public meetings and public involvement activities is available in appendix A.

Based on input from all five Southern Appalachian forests and the public on the five forests, changes were made and additional alternatives were developed to address a variety of issues and to provide a spectrum of alternatives to analyze and consider. The original four alternative themes (with some modifications) became Alternatives A-D, the Current Direction (No-Action) Alternative became Alternative F, and three new alternatives (Alternatives E, G, and H) were developed.

Later, a ninth alternative (Alternative I) was developed. A set of "design criteria" was developed for this alternative which incorporated parts of Alternatives A-H where there appeared to be some general agreement from our public. Also, as a part of the design of Alternative I, it was meant to "roll" through different iterations of coordinating efforts with our public. As a result of this development strategy, this alternative was often referred to as the "Rolling Alternative."

ALTERNATIVES ELIMINATED FROM DETAILED STUDY

As described above, there were originally nine different alternatives. However, as the planning process proceeded, it was determined that two of the alternatives did not need to be further evaluated in greater detail. Descriptions of those two alternatives and the reasons they were not studied further are explained below.

Alternative C

Alternative C would emphasize resource management with minimal human intervention to the natural resources. Active management would be for the protection of resources, for meeting legal requirements, and for maintaining current recreation opportunities.

Potential old-growth areas would, within a few decades, come to represent the majority of the forest as a result of minimal management activity. There would be no regular, periodic harvest of green timber; therefore, no "suitable" forest land. The landscape character would change, moving toward high scenic integrity. Emphasis would be on dispersed and non-motorized recreation opportunities. No new developed recreation facilities would be constructed.

All inventoried roadless areas would be recommended for wilderness designation. Risk of loss of critical habitat for threatened and endangered species, danger to forest visitors, risk of damage to private property through Forest Service inaction, or introduction of an exotic pest would be considered unhealthy forest conditions requiring human intervention. Human intervention would also be used to maintain or increase existing rare communities. The majority of the eligible wild and scenic rivers would be recommended for inclusion to the National Wild and Scenic Rivers System. Roads not needed for legal requirements and other resource needs would be closed or obliterated.

Reasons Alternative C Eliminated From Detailed Study

The management prescriptions applicable to this alternative were allocated and mapped, and some preliminary estimates of the impacts of this alternative were made. After considering this preliminary information, it was determined that Alternative C did not need to be further evaluated in detail in this EIS. The reasons are: 1) From further analyses it was determined that this alternative, as originally envisioned, would not meet all the legal requirements of the National Forest Management Act of 1976 (NFMA), the Multiple-Use Sustained-Yield Act of 1960 (MUSYA) and the Endangered Species Act of 1973 (ESA); 2) Alternative C only addresses some, but not all, of the forest planning issues that have been identified by the public; 3) Other alternatives considered in detail provide for relatively low levels of management activities; and 4) Alternative C is similar to the "Minimum Level Benchmark" discussed in Appendix B.

The 219 regulations specify that the planning team should "formulate a broad range of reasonable alternatives according to NEPA procedures" (36 CFR 219.12(f)). With respect to meeting NEPA procedures, the alternatives developed need to respond to the "purpose and need". The "purpose and need" of revising the forest plan is to address the changing conditions that were identified in the Southern Appalachian Assessment, the Forest's Analysis of the Management Situation, and the changing public values as represented by the 12 common issues and 2 local issues. Alternative C, with its emphasis on "minimal human intervention" would not address all these issues, and would not meet the "purpose and need" as required by NEPA.

Another expression of the "purpose and need" of the forest plans is in the NFMA regulations where it states that the "resulting plans shall provide for multiple use and sustained yield of goods and services from the National Forest System in a way that maximizes long term net public benefits in an environmentally sound manner" (36 CFR 219.1). The Multiple-Use Sustained Yield Act states that the Secretary of Agriculture should "develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained there from" (Section 2). Again, with its focus on "minimal human intervention", Alternative C is not an alternative that would provide "for multiple use and sustained yield of goods and services".

Additionally, the requirement to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR 219.19) would not be met. When this alternative was originally developed, it was thought that relatively few acres would need to be "actively managed" in order to meet this requirement. However, after more analysis was conducted on the habitat needs of various species, it was determined that there are a number of species that depend on ecological communities that can only be maintained by frequent levels of disturbance. As is explained in Chapter 3 of this EIS, a significant level of management is needed (at least over the next 10 to 50 years) to restore and maintain these disturbance-dependant communities. A certain amount of "human intervention" is needed to get these communities into the desired conditions of composition and structure, so that in the future, natural disturbances along with appropriate prescribed fire levels could maintain these communities. However, the levels of management activities that would be needed over the next 10 to 50 years to create these conditions would be inconsistent with the overall goal of Alternative C to have "minimal human intervention".

To further illustrate the need for a certain level of active management, Chapter 4 of the Southern Forest Resource Assessment (Effects of Forest Management on Terrestrial Ecosystems) states:

- "The exact nature and condition of these forests and disturbance regimes are unknown, but the presence of large grazing herbivores and fire-adapted forest communities suggests that much of this forest land was relatively open and subject to regular disturbances" (p. 92).
- "Today there are more forested acres in the South than in the early 1900s. These forests, however, are greatly altered from forests encountered by European settlers. … The common theme for the last 10,000 years is that forests were managed to meet human needs, including those of Native Americans" (p. 93).
- "We should recognize, however, that removal of all human disturbances will have profound effects on the region's biota" (p. 93).
- "To avoid regional population declines and species losses, land managers must have the flexibility to promote active management. This region's biota does not thrive in a static system, and intentional neglect does nothing but promote

> additional extinctions and endangerment to species at risk… This flexibility should not extend to the other extreme of promoting intensive forestry for wildlife conservation, but it does suggest that some level of active management will be necessary to maintain many still extant but imperiled species, including many found on present or set-aside lands" (p. 93).

With respect to the agency's "Healthy Forests Initiative", a management emphasis of the agency is to change the situation where forests, overloaded with fuels, are vulnerable to severe wildland fires. Minimizing "human intervention" would increase susceptibility of the forest to insect and disease outbreaks, which would create increased fuel-loading problems, and increase the risks to other resources and to adjacent private lands. Alternative C would not address these problems and areas of concern.

Apart from the low levels of human intervention, the other aspects of this alternative such as large acreages in old-growth or late–successional conditions, maintaining roadless area characteristics, and providing for an emphasis on dispersed recreation activities, etc., are similarly represented in Alternatives E and G.

While Alternative C would address some of the issues, there are other management issues that have been raised by the public that this alternative does not address. In addition to the forest health and wildlife habitat management concerns expressed above, Alternative C does not address the issue that there are demands for various forest products such as high-quality sawtimber, which are of limited supply from private lands, but are available from National Forest lands.

Lastly, the Minimum Level Benchmark is "the minimum level of management which would be needed to maintain and protect the unit as part of the National Forest System together with associated costs and benefits" (36 CFR 219.12(e)(1)(i)). This is essentially the same management emphasis as Alternative C and a further description of this level of management can be found in Appendix B.

As a result of all these factors, it was determined that further study of this alternative was not needed.

Alternative H

Alternative H would provide for active resource management to achieve multiple-use objectives with all lands classified as unsuitable for timber production. There would be some timber harvest, but not under a sustainable harvest schedule as is done on suitable forest land. The active resource management would focus on providing a wide diversity of wildlife habitats. Small human-made openings would be made to mimic natural gap openings. Emphasis would be on area sensitive, interior species habitats and these areas would be managed for high to very high scenic integrity.

Old-growth allocation and management would be primarily on lands already withdrawn from the suitable timber base. Restoration of degraded watersheds would be emphasized to improve aquatic habitats and water quality. Highways and roads in the forest, trail and river corridors, and recreation-use areas would have forest stands with few, if any, broken views. Recreation areas and opportunities would be increased throughout a variety of settings.

Inventoried roadless areas adjacent to existing wilderness would be recommended for wilderness designation. Non-native pests and/or undesirable species would be controlled. All wild and scenic rivers would be recommended for inclusion into the National Wild and Scenic Rivers System (WS&R) if they do not conflict with other resources. Eligible wild and scenic rivers not recommended for inclusion into the WS&R would be allocated to a management prescription that protects these rivers and manages them similarly to congressionally designated rivers. Public access (travel-ways, use corridors, waterways, and trails, including off-highway vehicles) would be increased in high-use areas and/or improved to provide more opportunities for recreation.

Reasons Alternative H was Eliminated from Detailed Study

When the management prescriptions applicable to this alternative were allocated, there was virtually no difference between this alternative and Alternative G. The allocations were essentially the same, and therefore, the environmental effects would be essentially the same. The only significant difference between Alternative G and Alternative H was that in Alternative G, the majority of those acres being managed through silvicultural harvesting methods were classified as acres "suitable for timber production," while in Alternative H, those same acres and same management activities would be classified as "unsuited for timber production." The timber harvesting levels planned for in Alternative H are close to the levels of harvesting planned for in Alternative G. Since the main difference is primarily an administrative classification change, and there would be no differences in the overall outputs and environmental effects, it was decided that this alternative did not need to be considered further in detail in this EIS.

ALTERNATIVES CONSIDERED IN DETAIL

Alternative A

- Goods and services to local economies emphasized.
- Timber management for sustained yield of high quality sawtimber.
- Wildlife management for public demand game and non-game species.
- Developed and dispersed recreation opportunities enhanced.
- High-quality scenery enhanced.
- Old growth on land withdrawn from suitable for timber production land base.
- Public access to the forest increased to enhance recreation opportunities.

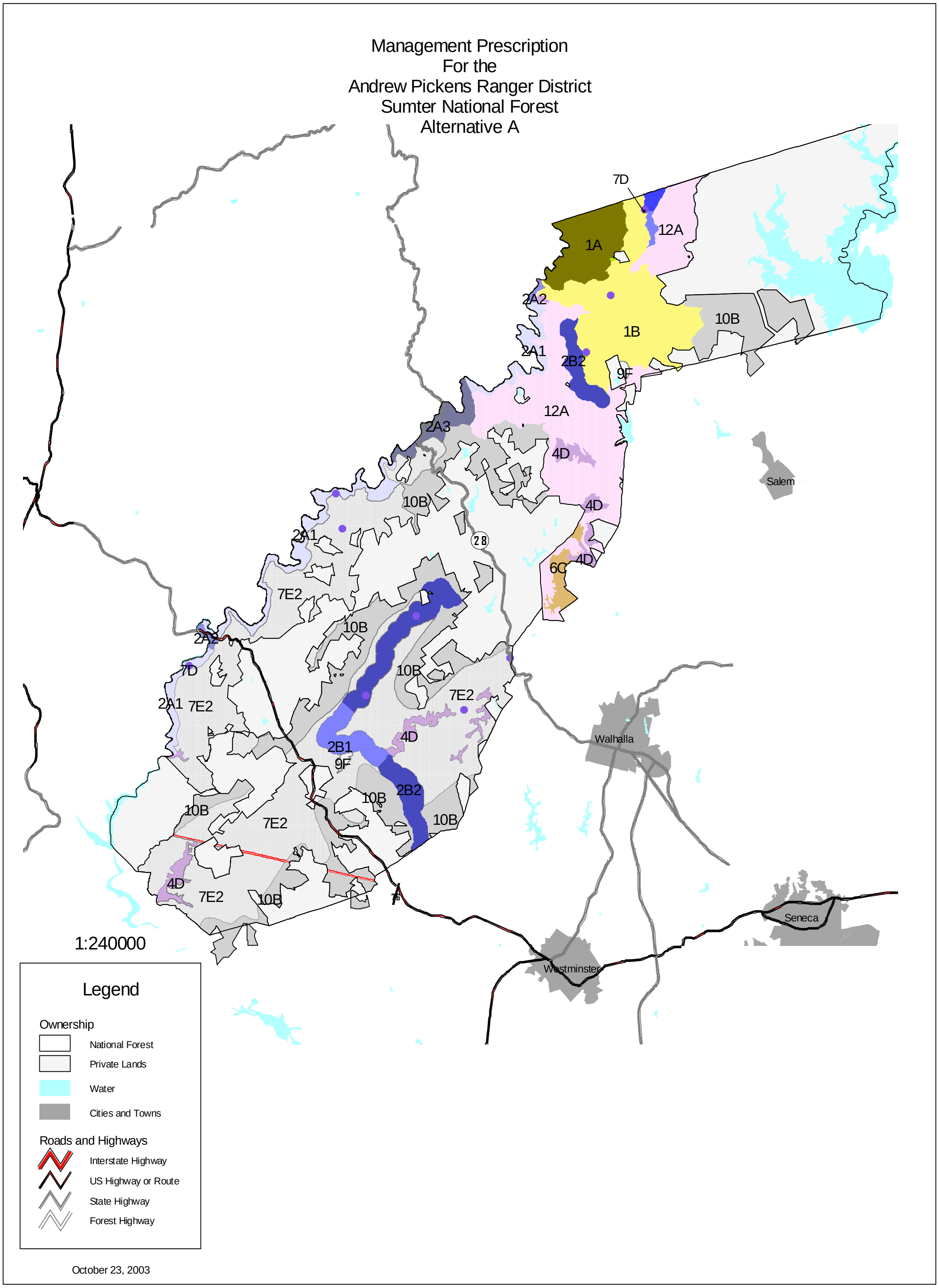
- Boating allowed on the Chattooga River above Highway 28 and below Burrell's Ford Bridge.
- Vegetation actively managed to reduce the risk of insects and diseases.

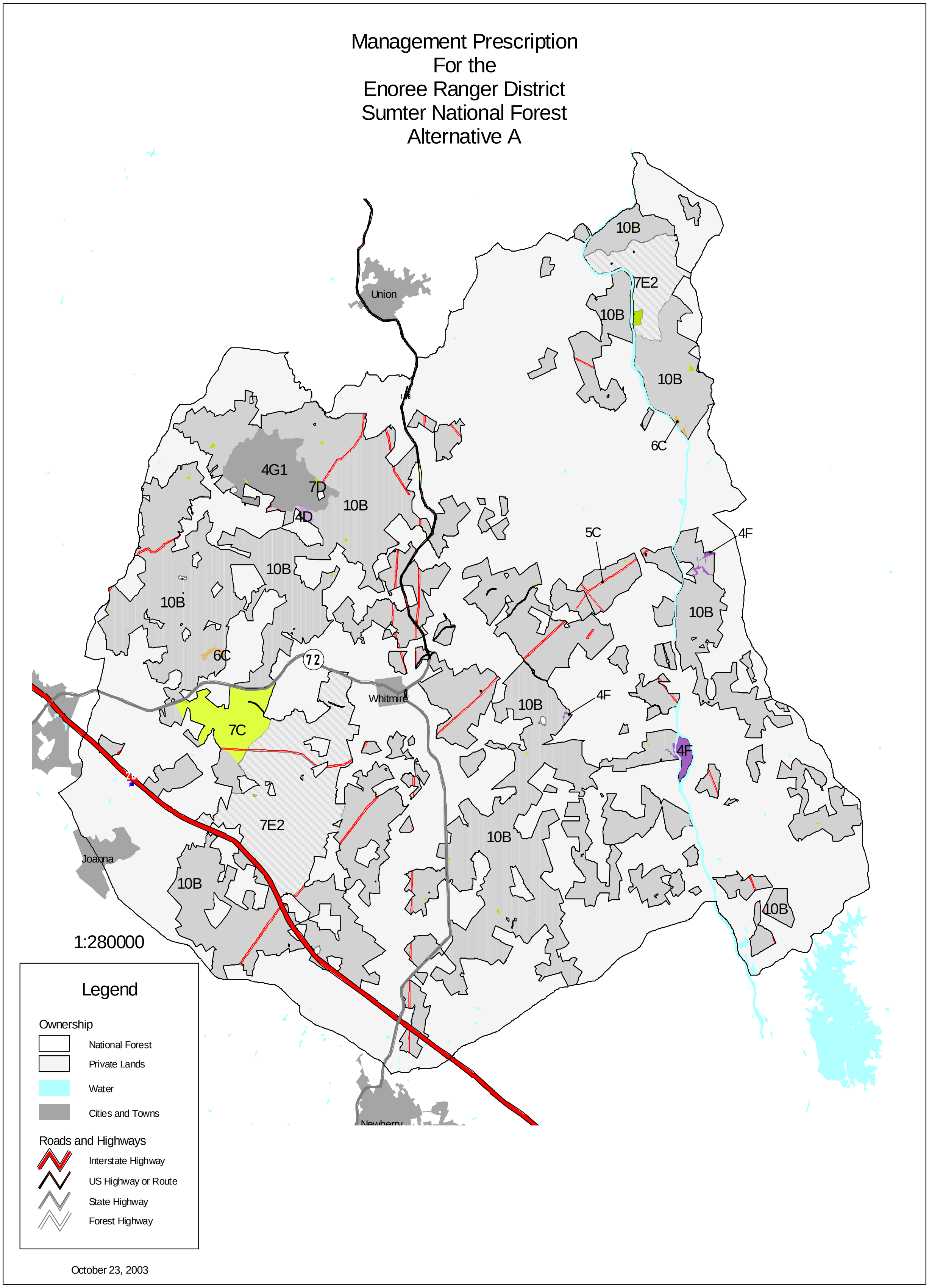
Alternative "A" would emphasize *production of goods and services beneficial to local economies and communities.* Local communities include any community that benefits economically from forest visitors and forest products. Timber management would provide a sustained yield of wood products with emphasis on high-quality sawtimber and public-demand species including game and other species. Developed and dispersed recreation opportunities and high-quality scenery would be provided in a variety of settings both natural and managed. These would include both commercial recreation and increased public access. Boating on the Chattooga River would be allowed between Burrell's Ford Bridge and Highway 28. (Please refer to Appendix H.)

Old-growth allocation and management would be primarily on lands already withdrawn (in current LMP) from the suitable timber base. Highways and roads in the forest, trail and river corridors, and recreation-use areas would have forest stands with few, if any, broken views. Southern Appalachian Assessment inventoried roadless areas adjacent to or in close proximity to wilderness areas that are high-use areas also would be recommended for wilderness designation. Vegetation would be actively managed to reach and maintain a condition of low risk of insect and disease problems, especially in those areas where timber production would be the emphasis or vegetation management would be permitted. Public access (travel-ways, use corridors, waterways, trails, including off-highway vehicle) would be increased in high-use areas and/or improved to provide for more recreation opportunities.

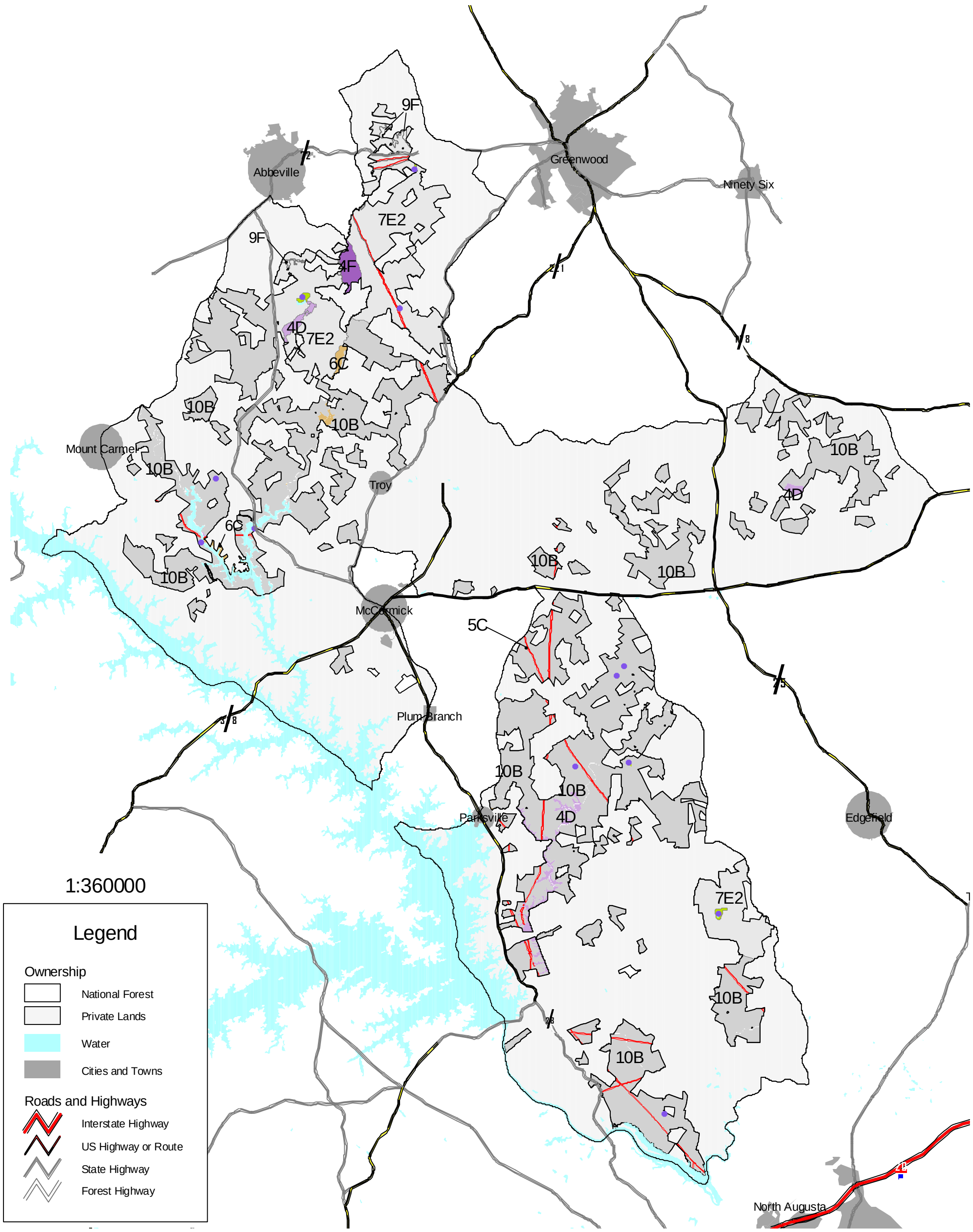
Legend

- 1.A-Designated Wilderness Area
- 1.B - Recommended Wilderness Study Area
- 2.A.1 - Designated Wild River Segments
- 2.A.2 - Designated Scenic River Segments
- 2.A.3 - Designated Recreational River Segments
- 2.B.1 - Eligible Wild and Scenic Wild River Segments
- 2.B.2 - Eligible Wild and Scenic Scenic River Segments
- 2.B.3 - Eligible Wild and Scenic Recreational River Segments
- 4.D - Botanical/Zoological Areas (All areas not shown)
- 4.F - Scenic Areas
- 4.G.1 - Calhoun Experimental Forest
- 5.A - Administrative Sites (All areas not shown)
- 5.C - Designated Utility Corridors
- 6.A - Emphasize Natural Processes
- 6.C - Old Growth Areas Managed with a Mix of Natural Processes and Restoration Activities (All areas not shown)
- 6.D - Old Growth Areas with a "Core" Surrounded by areas with extended forest rotations
- 6.E - Old Growth Area with a "Core" Surrounded by Areas under Uneven-Aged Management
- 7.A - Scenic Byway Corridor
- 7.C - OHV Use Areas
- 7.D - Concentrated Recreation Zone
- 7.E.1 - Dispersed Recreation Areas
- 7.E.2 - Dispersed Recreation Areas with Vegetation Management
- 8.A.1 - Mix of Successional Forest Habitats
- 8.A.2 - Area-Sensitive Mid- to Late-Successional Forest Habitats
- 8.B.2 - Woodland and Grassland Savanna Habitats
- 8.C - Wide Ranging Area-Sensitive Species (or Black Bear Habitat)
- 8.D - Red-Cockaded Woodpecker Habitat Management Areas
- 9.A.3 - Watershed Restoration Area
- 9.A.4 - Aquatic T/E/S Watersheds
- 9.E - Maintenance and Restoration of Xerix Pine and Pine-Oak Forests
- 9.F - Rare Communities (All areas not shown)
- 9.G.2 - Maintenance and Restoration of Upland Oak-Hickory and Mixed Pine-Oak Forests
- 9.H - Maintenance and/or Restoration of Plant Associations in the Chattooga River Watershed
- 10.A - Sustained Yield Timber Management
- 10.B - High Quality Forest Products
- 11 - Riparian Corridors (All areas not shown)
- 12.A - Remote Backcountry Recreation - Few Roads
- 12.B - Remote Backcountry Recreation - Non-Motorized
- Private Lands
- District boundary
- Town/City
- Primary Road
- Secondary Road


Management Prescription
For the
Andrew Pickens Ranger District
Sumter National Forest
Alternative A
7D
12A
1A
2A2
1B
10B
2A1
2B2
9F
12A
2A3
4D
Salem
10B
4D
2A1
28
4D
6C
7E2
10B
2A2
10B
7D
7E2
2A1
7E2
Walhalla
4D
2B1
9F
2B2
10B
10B
10B
7E2
4D
7E2
10B
Seneca
Westminster
1:240000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003


Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative A
Union
Whitmire
Joanna
Newberry
72
10B
7E2
6C
4G1
7D
4D
5C
4F
7C
1:280000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003

Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative A



October 23, 2003

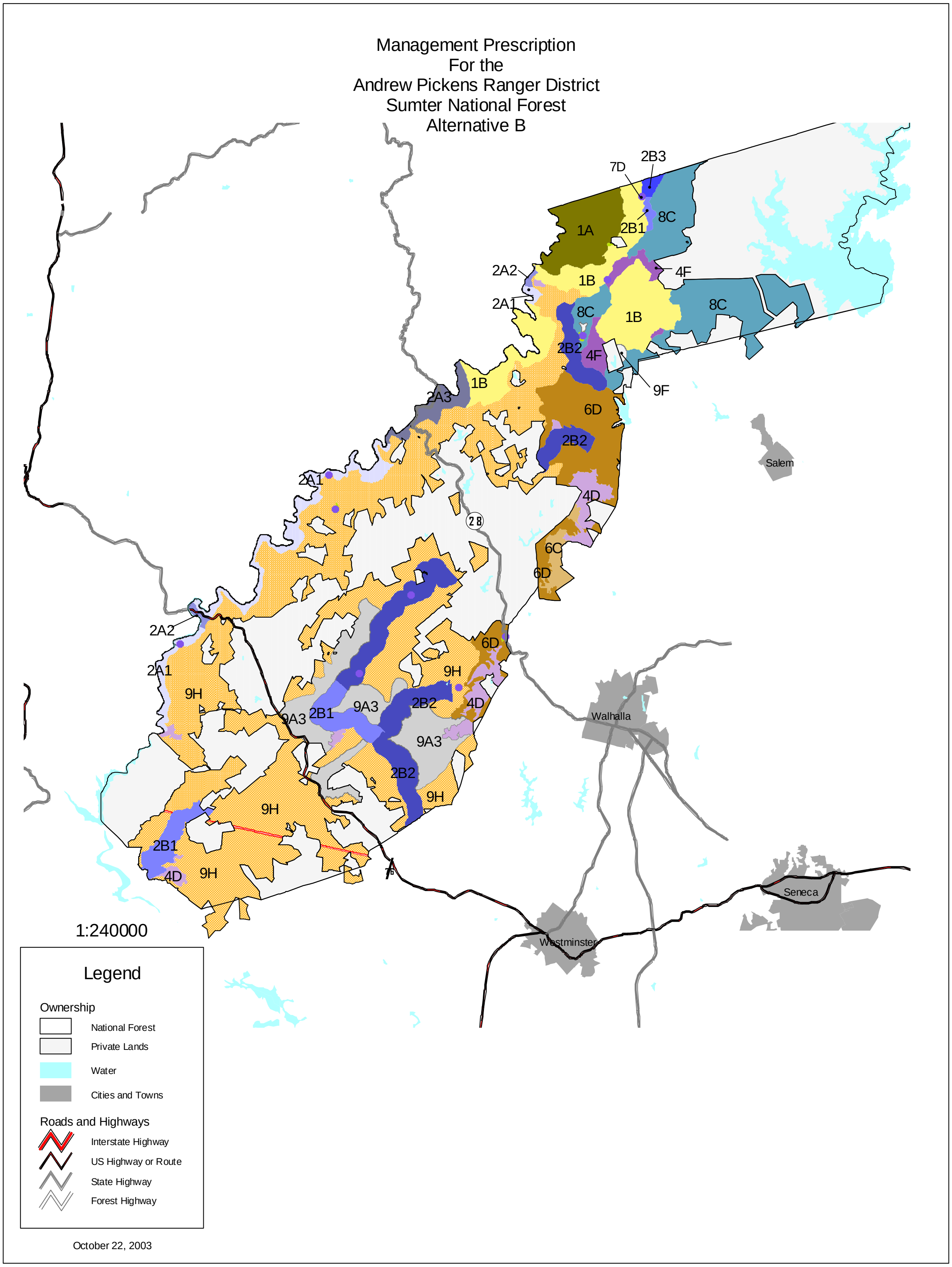
Alternative B

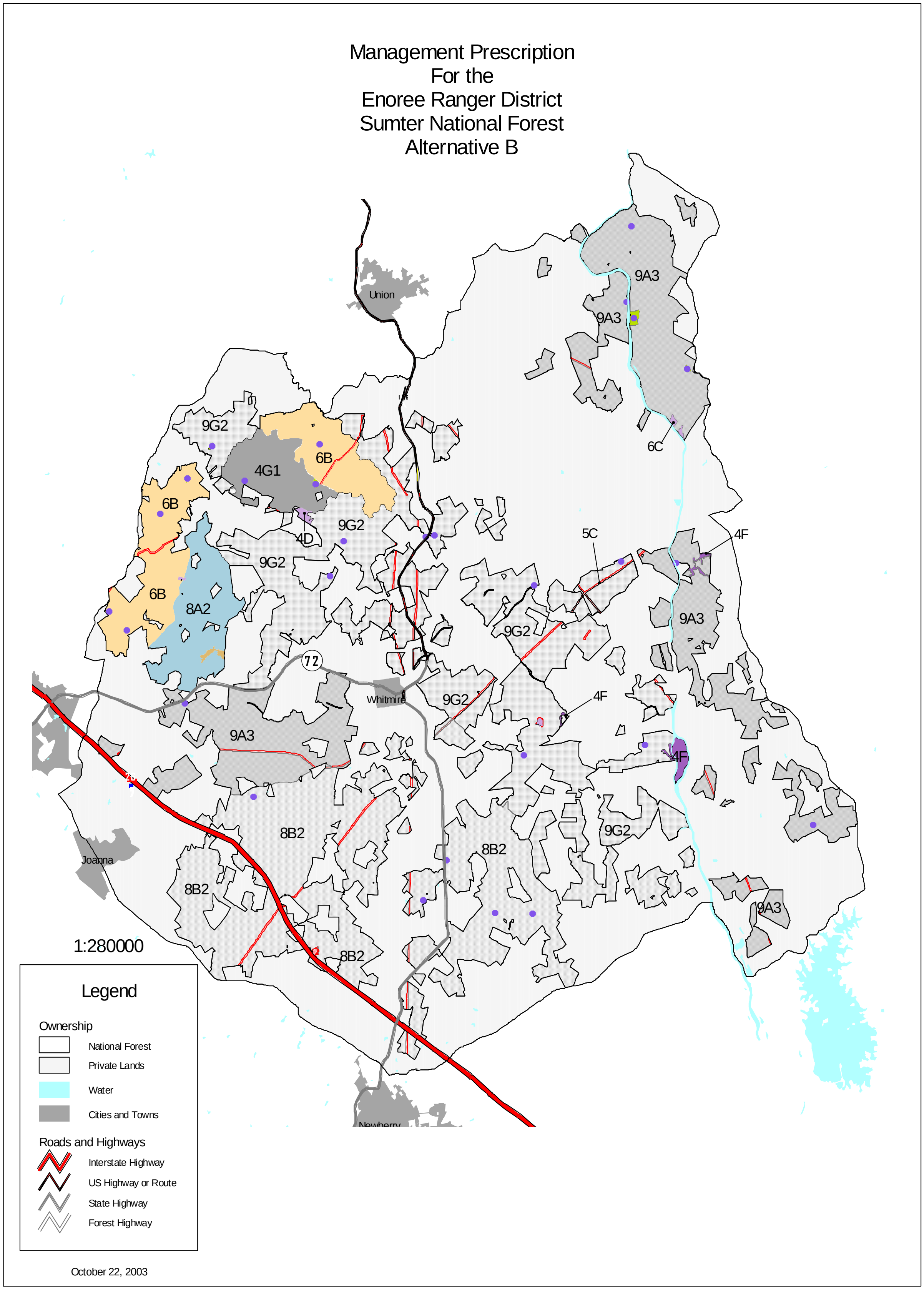
- Biologically driven to emphasize restoring the natural resources and processes.
- Creating and maintaining wildlife habitats emphasized.
- Natural process would be mimicked in a natural landscape pattern.
- Large and small openings may be created.
- Variety of recreation opportunities available if compatible with restoration.
- Equestrian use would be restricted to designated routes.
- Timber management done if wildlife habitats enhanced.
- Old growth emphasized with goal to create pre-settlement conditions.
- Riparian ecosystems emphasized.
- Scenic qualities would be enhanced over time (may have short-term impacts).
- Roadless areas with high value wildlife needs would not be recommended for wilderness.
- The role of insects and disease in ecosystem would be accepted, except in epidemic conditions. Non-native pests would be controlled.
- Generally, amount of long-term permanent access would be reduced. Access in the short-term may increase as needed to achieve management goals.
- Boating would not be allowed on the Chattooga River above Highway 28.

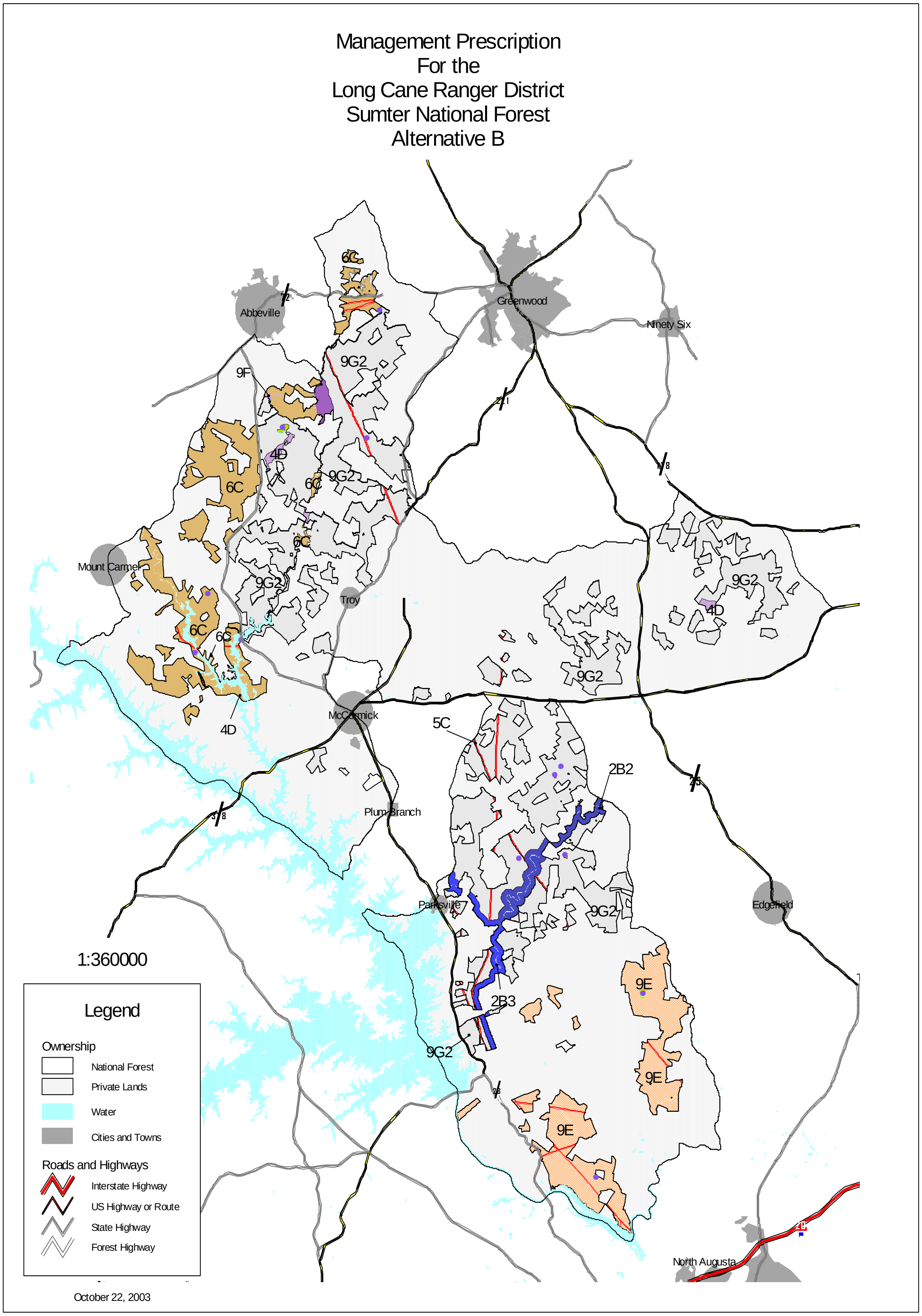
Alternative B would be *biologically driven*, emphasize *restoring the natural resources and processes, and emphasize creating and maintaining wildlife habitats*. Emphasis would be on restoration of vegetation to potential natural vegetation (plant associations) based on the ecological potential and capability of the land and on providing a mix of wildlife habitats for game and non-game species. Restoration activities would occur in areas where technology is available to implement. When possible, natural processes would be mimicked in a natural landscape pattern. Restoration activities would produce both large and small openings. Long-term restoration goals would be established for areas where technology is not currently available or for areas where restoration activities cannot be implemented or completed within the life of the revised LMP. A variety of recreation settings would occur in areas compatible with restoration activities and in non-restoration areas. Management of wood products would only occur in concert with restoration management and creation of wildlife habitats. Timber sales would become a by-product of restoration management and wildlife habitats.

The long-term goal would be to provide old-growth conditions by old-growth community types within the ecological province or section similar to that existing before large-scale, extensive pioneer settlement and land uses. Riparian ecosystems would be managed to maintain water quality and aquatic ecosystems and to restore degraded conditions. Timber production would be a result of management to restore and maintain specific impaired or degraded resources, natural processes, communities, and wildlife habitats. In some areas of the forest, scenic resources would move gradually toward high to very high scenic integrity. Restoration of areas would result in short-term, low to moderate scenic integrity but with a long-term goal of high scenic integrity. A wide variety of recreation opportunities would be provided. Roadless areas with identified restoration needs or

wildlife habitat needs in conflict with wilderness designation would not be recommended for wilderness; other roadless areas could be recommended for wilderness study. The role of native insects and disease would be accepted, except that epidemics would be suppressed to reduce large-scale catastrophic tree mortality. Non-natives such as gypsy moth, hemlock wooly adelgid, Japanese privet, and kudzu would be controlled. Any restoration needs would be made compatible with wild and scenic river classification and its outstandingly remarkable values. In instances of degraded resources, areas in need of restoration, or areas where wildlife habitat needs occur, access could be temporarily provided to maintain or restore desirable ecological conditions. Access would be reduced as needed to restore and protect aquatic systems, soils, and plant and animal communities.


Management Prescription
For the
Andrew Pickens Ranger District
Sumter National Forest
Alternative B
2B3
7D
8C
1A
2B1
2A2
1B
4F
2A1
8C
1B
8C
2B2
4F
9F
1B
2A3
6D
2B2
Salem
2A1
4D
28
6C
6D
2A2
6D
2A1
9H
9H
4D
9A3
2B1
9A3
2B2
Walhalla
9A3
2B2
9H
9H
2B1
4D
9H
Seneca
1:240000
Westminster
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 22, 2003


Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative B
Union
Whitmire
Joanna
Newberry
72
9A3
6C
4F
5C
9G2
6B
4G1
4D
8A2
8B2
1:280000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 22, 2003


Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative B
Abbeville
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
Plum Branch
Parksville
Edgefield
North Augusta
9F
9G2
6C
4D
5C
2B2
2B3
9E
1:360000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 22, 2003

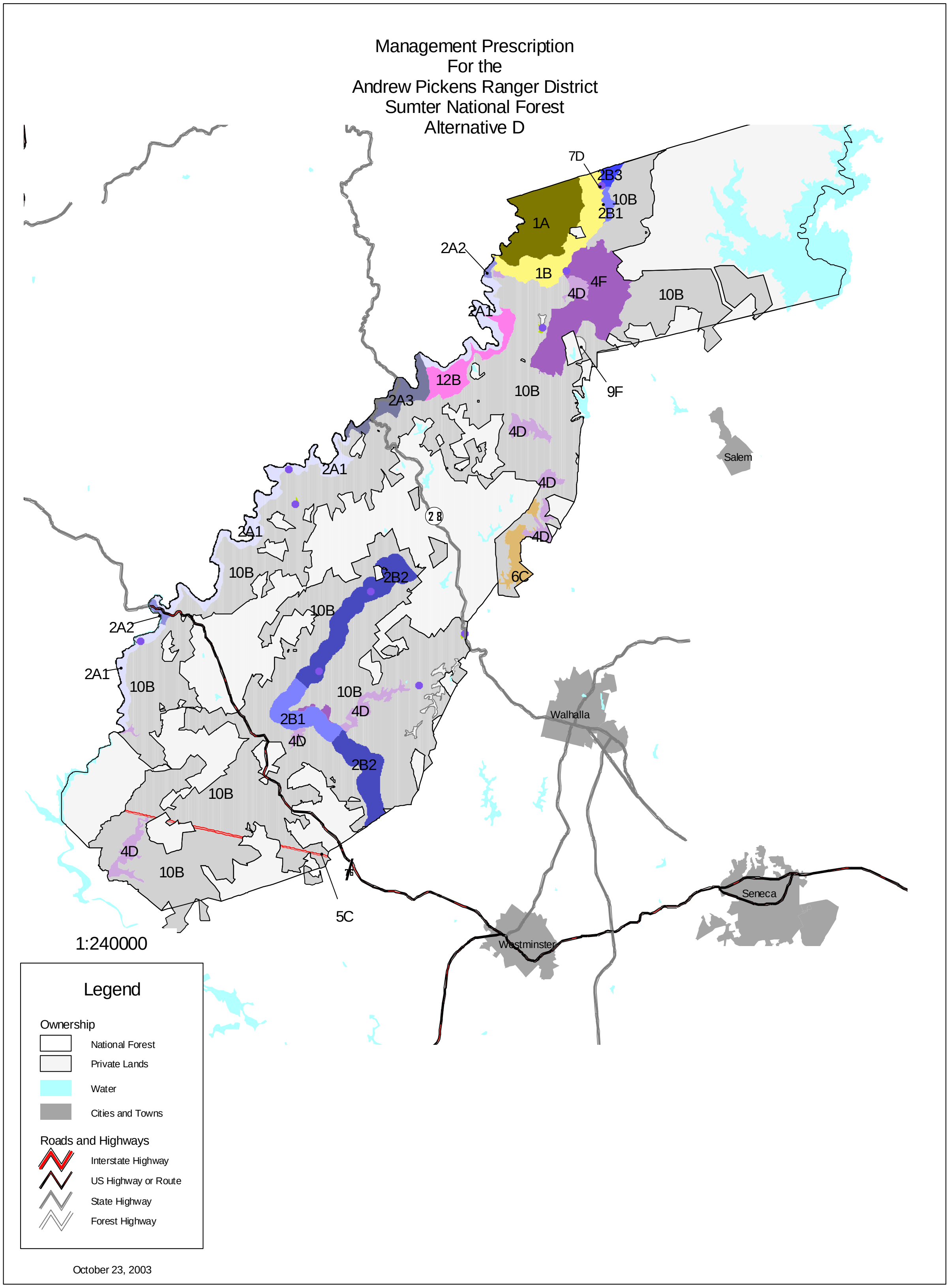
Alternative D

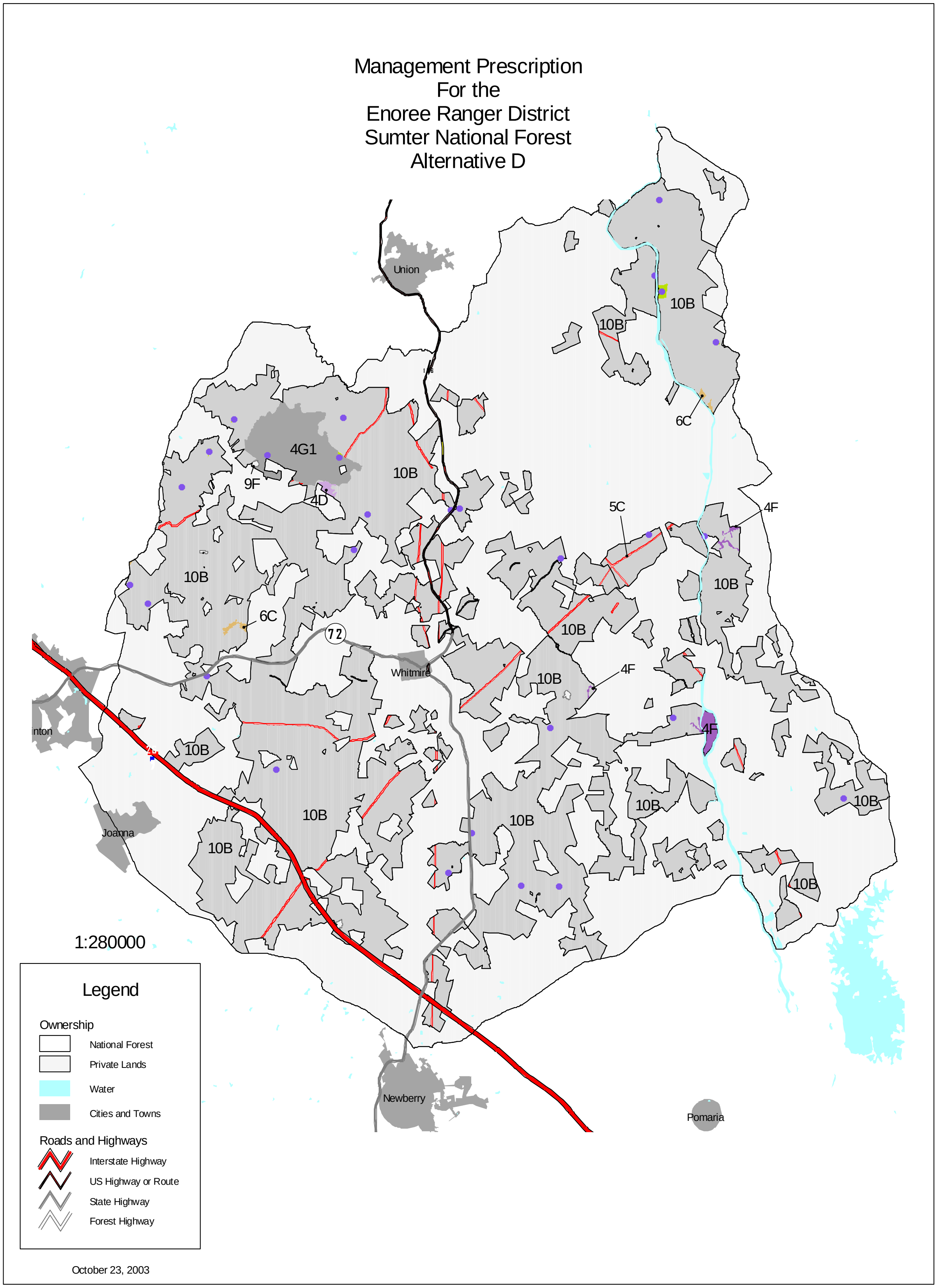
- All suitable lands would be available for sustained yield management.
- Major forest types would have a specific target "rotation" age and would be harvested and replaced with a new forest.
- Approximately equal acres in each age class.
- Age classes would be distributed across the forest in 15-40 acre blocks.
- Production of wood products and a variety of aquatic and wildlife habitats would be emphasized.
- Developed and dispersed recreation opportunities provided.
- Old growth provided on unsuitable lands.
- Access would increase and be maintained to facilitate alternative goal.
- Boating would not be allowed on the Chattooga River above Highway 28.

The emphasis of Alternative D would be to reach and *maintain a balanced age class*. All suitable for timber production lands would be available for sustained-yield management. On suitable lands, each of the major forest groups–pine, mixed, and hardwood–would have a specific target "rotation age" or age at which it would be harvested and replaced with a new forest.

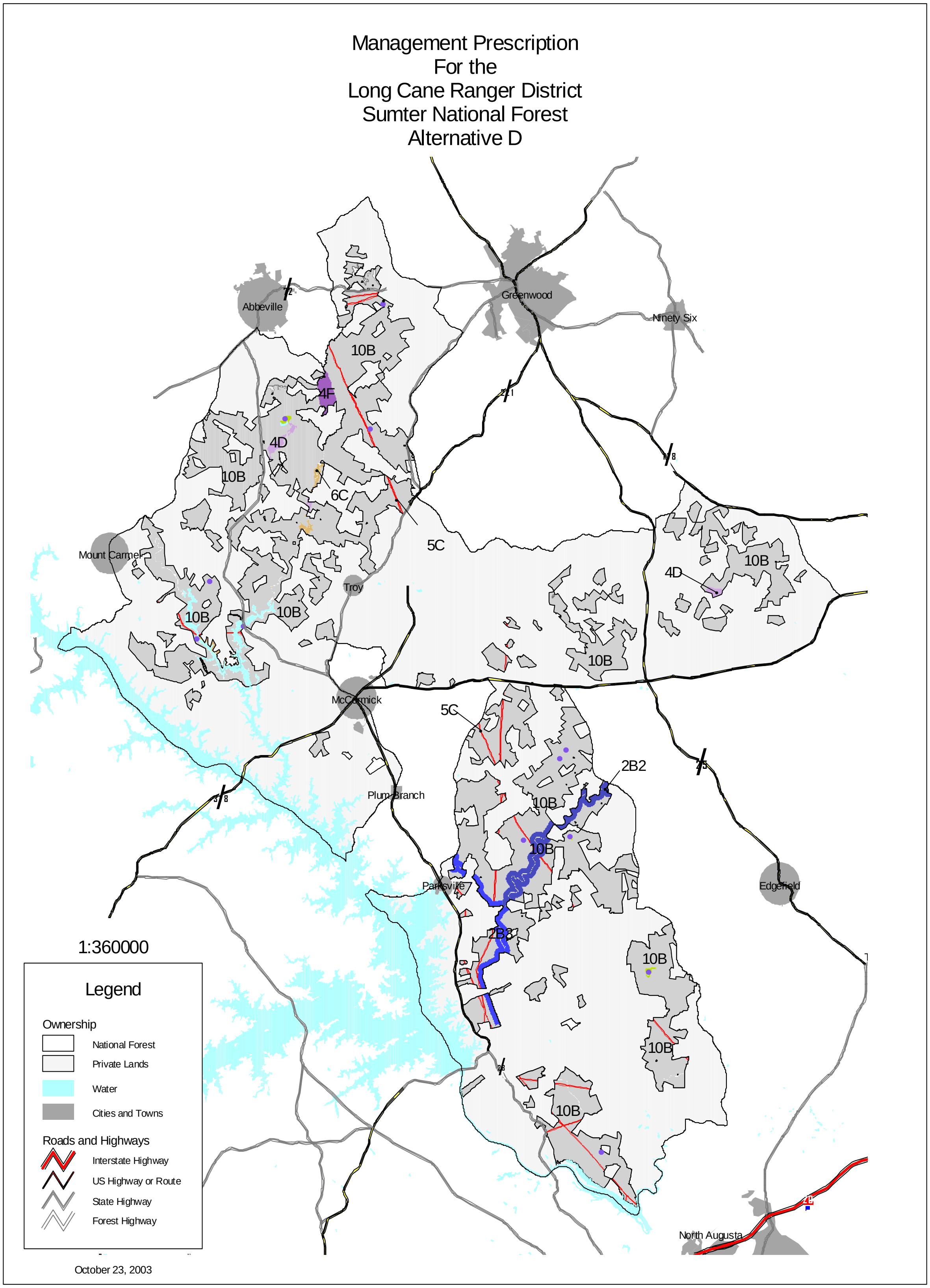
There would be an approximately equal number of acres within each 10-year age class up to that rotation age. This "balance of age classes" would occur on lands identified as suitable and would be distributed in 15- to 40-acre blocks throughout the lands being managed for sustained-yield timber production. Pine, mixed, and hardwood forests older than the rotation age also would occur on large blocks of land already withdrawn from sustained-yield timber production. Production of both commercial wood products and a variety of aquatics/wildlife habitats would be emphasized. Developed and dispersed recreation opportunities would be provided in a variety of settings both natural and managed. Water quality and riparian areas would be protected through BMPs, streamside management zones, and standards, and restored if needed. Streamside management zones would be included in the suitable timber base, with minimum widths based on applicable regulations.

Large- and medium-sized blocks of old growth would be provided only on lands unsuitable for timber production. Small blocks would be scattered throughout the suitable lands on steep slopes, streamside management zones, or similar areas. The forest would appear highly variable in tree sizes, and openings in the canopy would be seen from roadways and vista points. Potential for roaded natural experiences would increase as access roads for timber harvest are built or improved. Semi-primitive experiences would be primarily on unsuited lands. Only those roadless areas that are already withdrawn from sustained-yield timber production by Congress, the Secretary of Agriculture, or the Chief of the Forest Service would be recommended as wilderness. Insects, diseases, and non-native plant and animal species on suitable lands would be actively controlled and prevented. Some of the eligible wild and scenic rivers would be recommended for inclusion to the WS&R. Access would be developed, maintained, and used as needed to meet the goal of balanced age classes, wildlife habitats, and production of timber products.


Management Prescription
For the
Andrew Pickens Ranger District
Sumter National Forest
Alternative D
7D
2B3
10B
2B1
1A
2A2
1B
4F
4D
10B
2A1
12B
2A3
10B
9F
4D
Salem
2A1
4D
28
2A1
4D
10B
6C
2B2
10B
2A2
2A1
10B
10B
4D
2B1
4D
Walhalla
2B2
10B
4D
10B
5C
Seneca
Westminster
1:240000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003



Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative D
Union
10B
10B
6C
4G1
9F
4D
10B
5C
4F
10B
10B
6C
72
10B
Whitmire
10B
4F
4F
10B
10B
10B
10B
10B
10B
Joanna
10B
Newberry
Pomaria
1:280000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003


Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative D
Abbeville
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
Plum Branch
Parksville
Edgefield
North Augusta
10B
4F
4D
6C
5C
2B2
2B3
1:360000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003

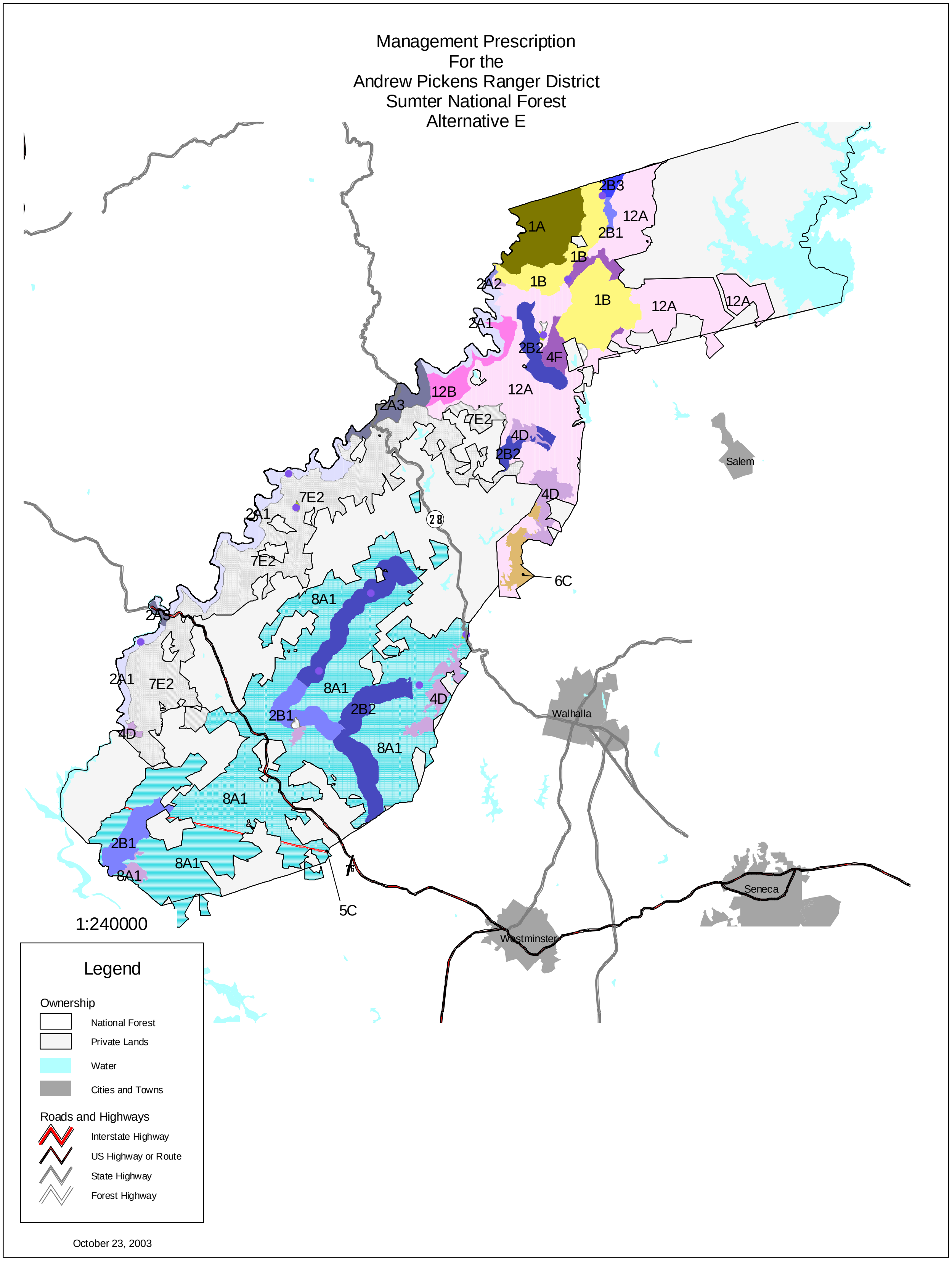
Alternative E

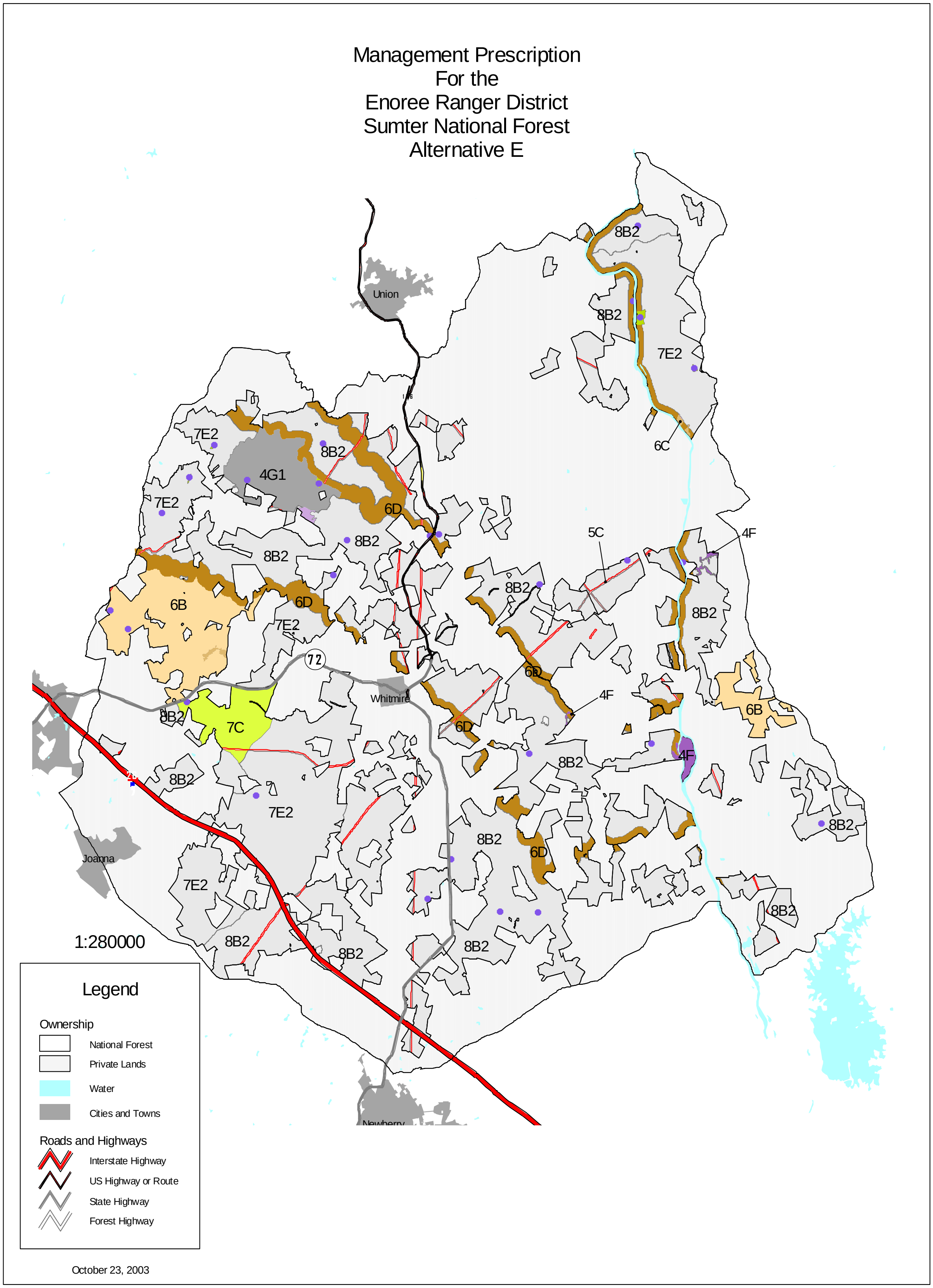
- Active resource management to attract recreation users.
- Most areas would maintain a forest canopy.
- Large block of the forest would be maintained in roadless condition to provide remote, backcountry recreation.
- A variety of developed and dispersed recreation opportunities would increase.
- Off-highway vehicle (OHV) use would increase.
- A variety of wildlife habitats would be maintained across the landscape.
- Timber management would be geared to high-quality large diameter trees.
- Boating would be allowed on the Chattooga River above Highway 28 and below NC-1107 (Grimshawes Bridge).
- Equestrian use would be restricted to designated routes.

A natural setting and concentrated facilities that could attract a *variety of recreation users* would be provided. Active resource management would be concentrated in certain locations and support recreation use and visual quality. Most areas would maintain a forested canopy. Large blocks of the forest would be maintained in a roadless condition to provide remote, backcountry recreation. Dispersed and developed recreation areas and opportunities would be increased. A variety of recreation experiences would occur, including concentrated use and OHV use. Boating on the Chattooga River would be allowed between NC-1107 (Grimshawes bridge) and Highway 28. (Please refer to Appendix H.)

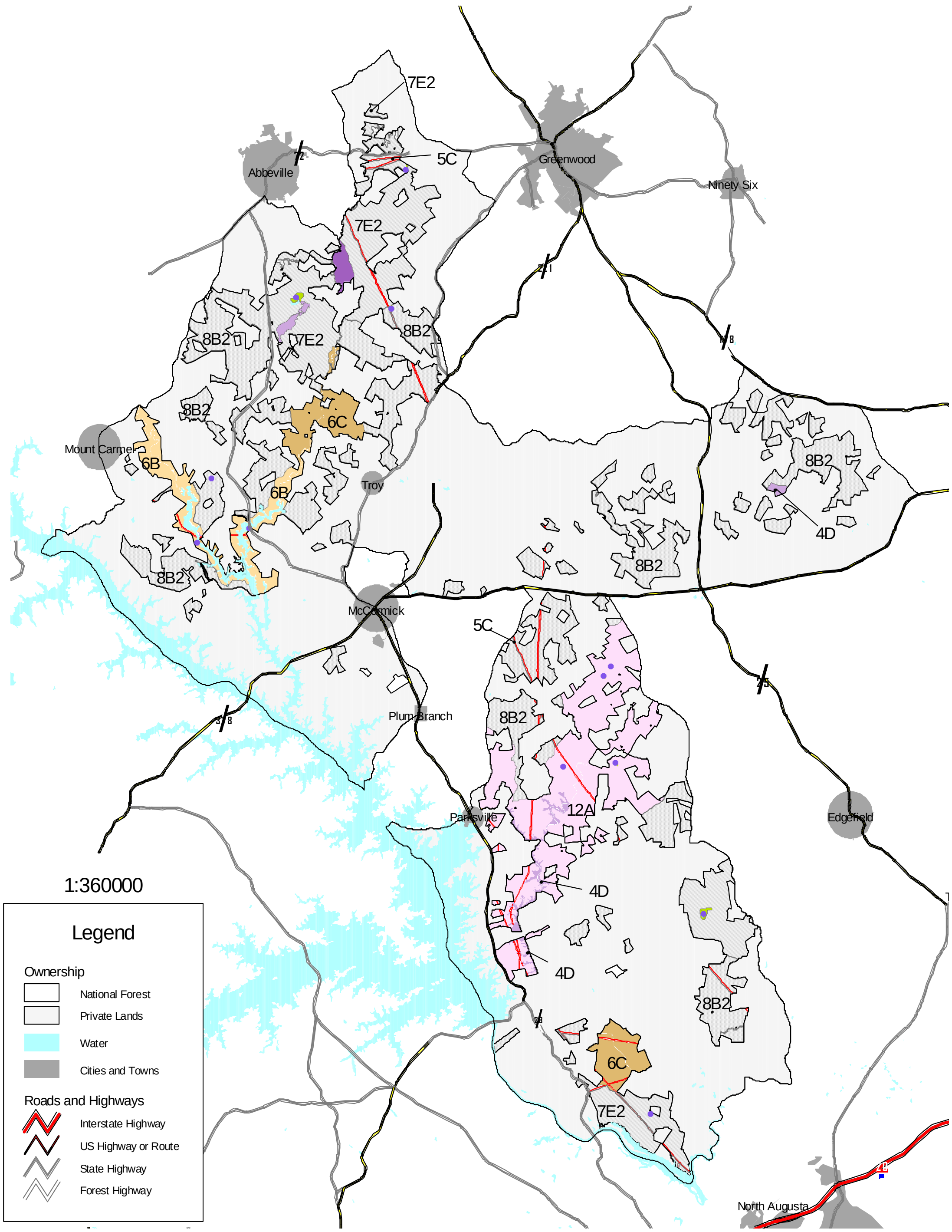
A variety of different wildlife habitats would be maintained in blocks across the landscape. Habitat for area sensitive species would be accomplished through maintenance of a variety of successional classes in a manner that would be unnoticeable to most forest visitors. A substantial amount of the forest would be allocated to providing old growth for biological and aesthetic settings in large, medium, and small patches.

Riparian ecosystems and streamside management zones would be designated, through allocation or standards, to provide water quality protection and improvement. The overall long-term timber product objective would be large-diameter and high-quality sawtimber for species capable of reaching that objective. Highways and roads in the forest, trail and river corridors, view sheds, and recreation-use areas would have forest stands with few, if any, broken views. Many insect and disease impacts would be tolerated as part of a functioning natural ecosystem. Most wild and scenic rivers would be recommended for addition to the WS&R, with primary emphasis on protecting the resources. Public access (travel-ways, use corridors, waterways, trails, including OHV) would be increased in high-use areas and/or improved to provide for more recreation opportunities.


Management Prescription
For the
Andrew Pickens Ranger District
Sumter National Forest
Alternative E
1A
2B3
12A
2B1
1B
2A2
1B
1B
12A
12A
2A1
2B2
4F
12B
12A
2A3
7E2
4D
2B2
Salem
4D
7E2
2A1
28
7E2
6C
8A1
2A3
8A1
2A1
7E2
4D
2B1
2B2
8A1
Walhalla
4D
8A1
2B1
8A1
8A1
5C
Seneca
Westminster
1:240000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003


Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative E
Union
Whitmire
Joanna
Newberry
72
8B2
7E2
6C
4G1
6D
5C
4F
6B
7C
8B2
1:280000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003

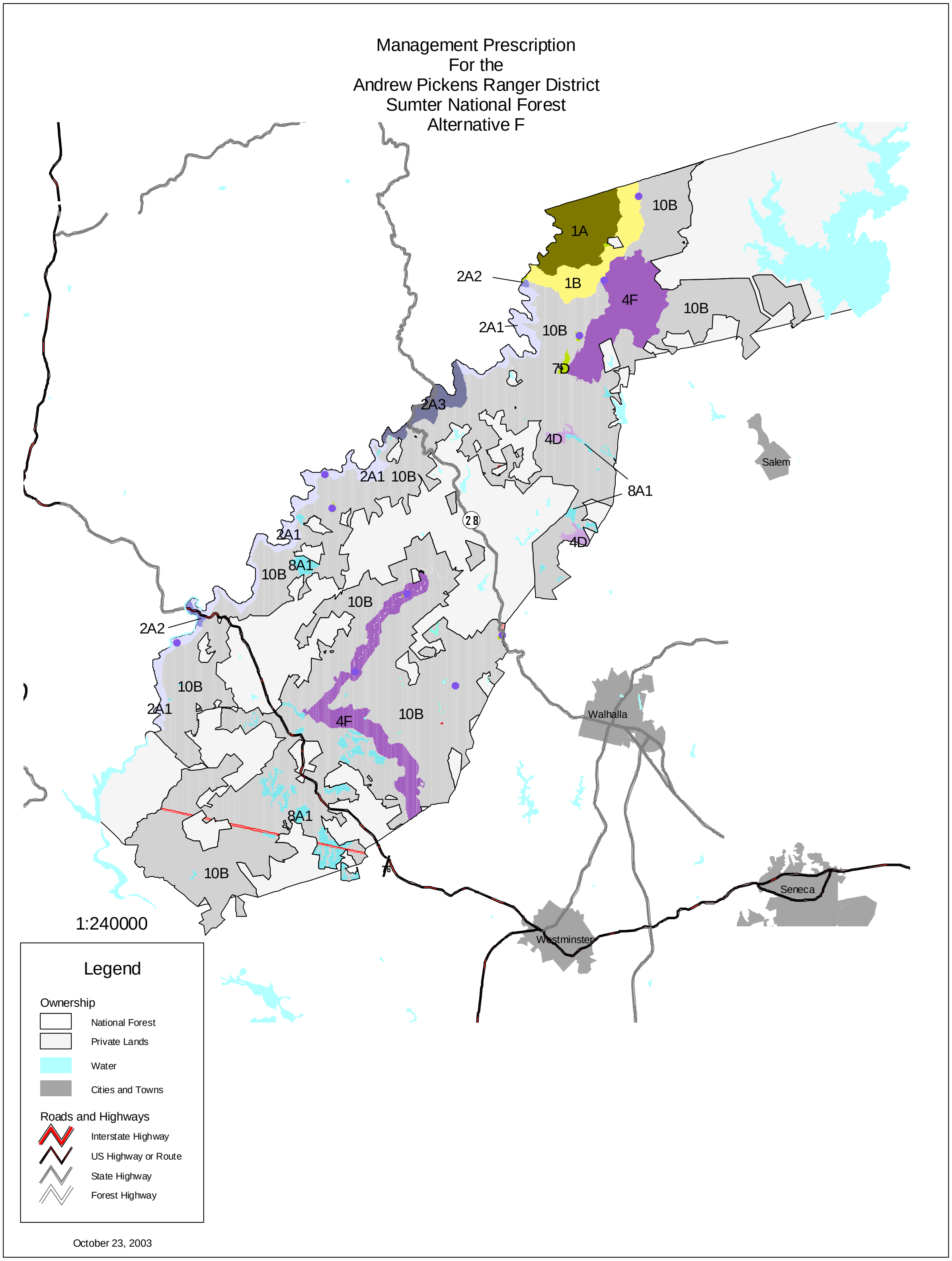
Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative E



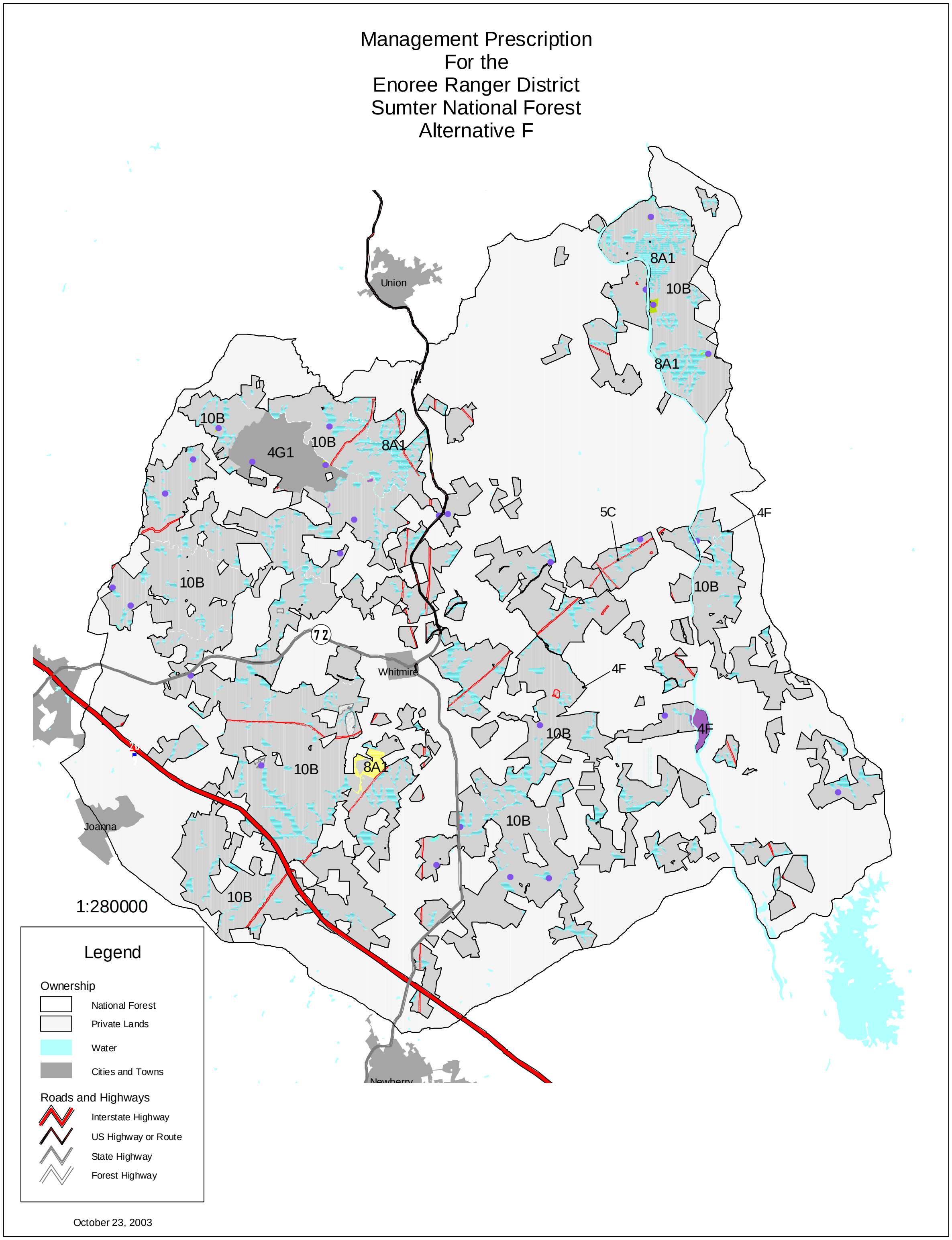
Alternative F (Current Direction/No Action Alternative)

- Suitable for timber production lands available for sustained yield management.
- Critical habitat for PETS will be managed and protected.
- Viable populations of all native vertebrate and plant species will be maintained.
- Eight "special areas" will be managed to preserve unique scenic, cultural, or biological values.
- The Chattooga Wild and Scenic River will be managed to provide a range of high quality recreation opportunities characteristic of wild and scenic rivers.
- Production of wood products and a variety of wildlife habitats would be emphasized.
- Developed and dispersed recreation opportunities would be provided.
- Boating would not be allowed on the Chattooga River above Highway 28.

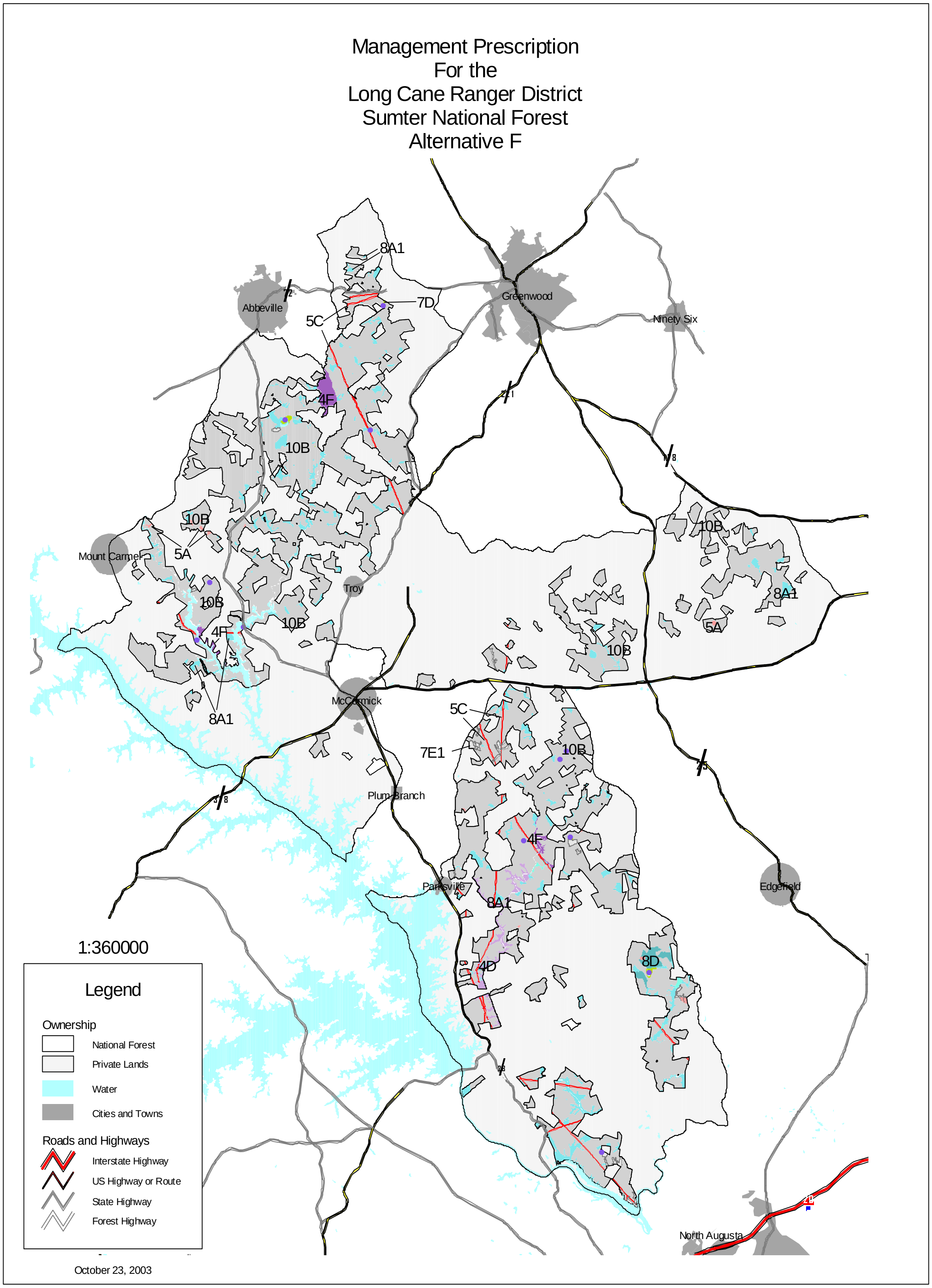
Current Management represents a continuation of the *Land and Resource Management Plan for the Sumter National Forest*, as amended. This forest plan was signed in August 1985 and has been amended 14 times since that date.



Management Prescription
For the
Andrew Pickens Ranger District
Sumter National Forest
Alternative F
1A
1B
2A1
2A2
2A3
4D
4F
7D
8A1
10B
28
76
Salem
Walhalla
Westminster
Seneca
1:240000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003



Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative F
Union
Whitmire
Joanna
Newberry
8A1
10B
4G1
5C
4F
72
1:280000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003


Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative F
8A1
7D
5C
Abbeville
Greenwood
Ninety Six
4F
10B
10B
5A
Mount Carmel
Troy
10B
4F
10B
10B
8A1
5A
8A1
McCormick
5C
7E1
10B
Plum Branch
4F
Parksville
8A1
Edgefield
4D
8D
North Augusta
1:360000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003

Alternative G

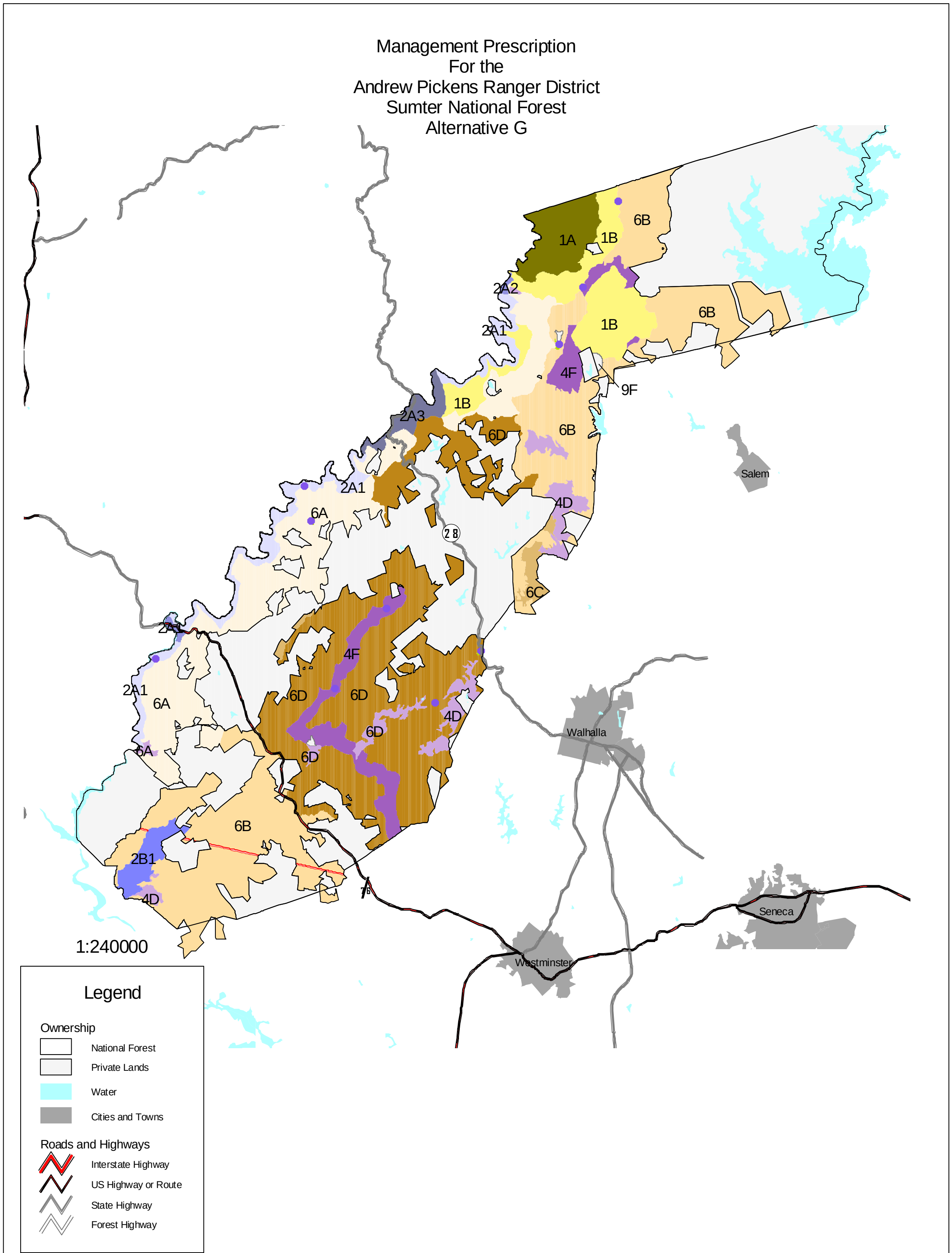
- Links large undisturbed areas together with corridors.
- Provides for threatened and endangered (T&E) management, species reintroduction, and watershed restoration
- Area-sensitive species habitat emphasized as well as a wide variety of other native plant and animal habitats, particularly late successional species.
- Nature oriented non-motorized recreation opportunities emphasized.
- Roadless areas recommended for wilderness.
- High quality timber produced outside the sensitive species habitat, movement corridors, and large undisturbed areas.
- Effects of native insects and diseases would be accepted.
- Fire would be used to restore natural ecosystem processes.
- Road network would be reduced.
- Roadless areas would be maintained as unfragmented habitat.
- Boating would not be allowed on the Chattooga River above Highway 28.

Alternative G would emphasize linking together, through land allocations, *movement corridors and large undisturbed areas,* T&E species, species reintroduction, and watershed restoration. National Forest System lands would provide habitat for area-sensitive species and a wide diversity of native plants and animals, particularly late-successional species. Habitats on private lands would be considered. Backcountry, late-successional wildlife species, and nature-oriented non-motorized recreation opportunities would be emphasized. Most roadless areas would be recommended for wilderness. Old-growth restoration areas around clusters of existing old growth and mature forests with old-growth characteristics would provide natural old-growth dynamics across the landscape of the Southern Appalachians. High-quality timber would be produced in long rotations in areas outside area-sensitive species habitat, movement corridors, and large undisturbed areas and would be accessed from existing roads. Effects of native insects and diseases would be accepted. Emphasis would be on establishing a naturally resilient forest that would avoid large outbreaks of forest pests. Fire would be used to restore natural ecosystem processes. Road network mileage would be reduced through closure and obliteration of roads not needed for ecosystem stewardship or restoration.

Emphasis would be on inventory, monitoring, conservation, and recovery of proposed, threatened, endangered, sensitive (PETS), and locally rare species. Riparian areas would be maintained as old growth for habitat and connectivity. Riparian area protection and restoration would be emphasized through watershed assessments and establishment of riparian corridors and reference watersheds. Naturally evolving and naturally appearing landscapes would be predominant. Recreation would take place within a context set by habitat needs and ecosystem function.

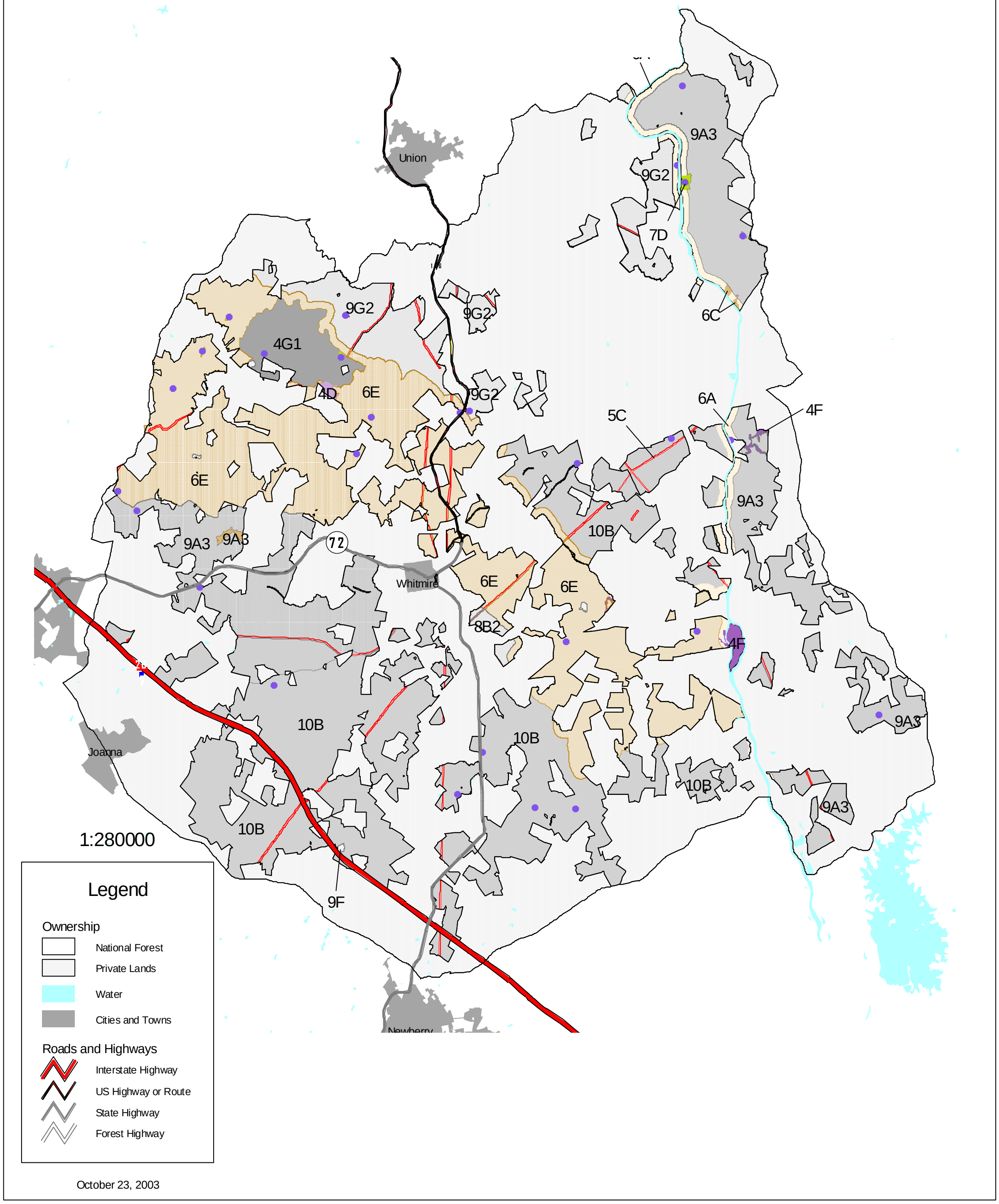
Semi-primitive, wildlife, and nature-oriented recreation opportunities would be emphasized. Developed facilities would occur where they do not detract from ecosystem function and landscape connectivity. Roadless areas would be maintained as unfragmented wildlife habitat, landscape linkages, old-growth restoration, wilderness

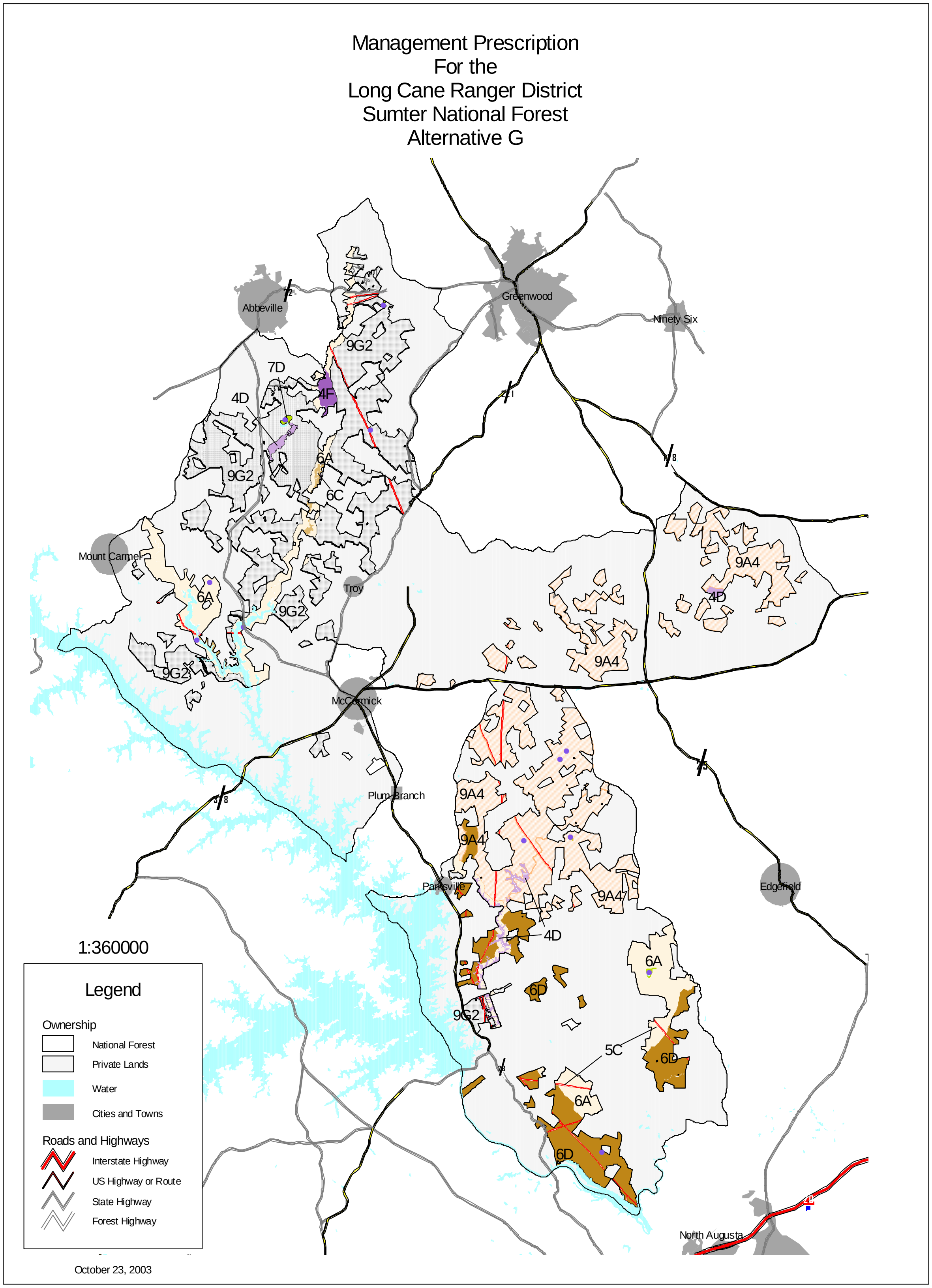
designation, and other management that would maintain their unfragmented habitat and ecosystem function. Non-native pests would be controlled by means that least impact ecosystem function and unfragmented habitat across the landscape. Eligible rivers that have outstanding botanical, ecological, fish, aquatic, or wildlife values would be recommended for inclusion to the WS&R.



October 23, 2003

Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative G




Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative G
Abbeville
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
Plum Branch
Parksville
Edgefield
North Augusta
9G2
7D
4D
4F
6A
6C
9A4
5C
6D
1:360000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003

Alternative I (Selected Alternative)

- Ecosystem restoration and maintenance emphasized.
- Watershed restoration.
- Riparian areas maintained and/or restored.
- Sustainability of diverse ecosystems emphasized.
- Variety of old-growth communities.
- Forest health a priority.
- High quality nature-based recreation opportunities.
- Non-motorized settings with natural appearing landscapes emphasized.
- Boating would not be allowed on the Chattooga River above Highway 28.

Alternative I emphasizes management of forest ecosystems through restoration and maintenance, which ensures healthy watersheds; provides for sustainable and diverse ecosystems that support viable plant, wildlife, and fish populations; and provides for high quality, nature-based recreation opportunities, especially in non-motorized settings with high quality landscapes.

Habitat conditions that are suitable for maintaining viable populations of all vertebrate species native to the planning area will be emphasized. Early successional habitats would be created and maintained by a variety of events, conditions, treatments, and activities.

Management actions would be taken where needed to conserve and recover threatened, endangered, sensitive, and locally rare species.

A variety of large, medium, and small old-growth patches would be managed to meet biological and social needs. All existing inventoried old growth would be protected and future old growth would be provided where forest management maintains old-growth conditions over time.

Healthy watersheds would be maintained and degraded watersheds would be restored to maintain or improve water quality and aquatic habitats. Riparian ecosystems would be essentially unchanged, except for any actions needed to restore riparian vegetation cover and riparian functions and values.

Where silvicultural activities are needed to achieve the desired composition, structure, and function of forest ecosystems, a result of such activities would be to provide a stable supply of a variety of wood products for local needs. Some of the best sites that are currently accessible could be managed to provide a supply of high quality sawtimber on the Piedmont. Other lands would provide a variety of products as a result of other management activities.

National forest landscapes have a natural appearing or naturally evolving character and are managed to maintain or enhance their scenic integrity.

A spectrum of high quality, nature-based recreation settings would be provided, and there would be an emphasis on providing those recreation opportunities that are not widely available on non-Federal lands. The acres of land providing semi-primitive and non-motorized recreation opportunities would remain the same or increase from the amount currently inventoried.

Inventoried roadless and unroaded areas would be managed to retain their unroaded character. Most of the inventoried roadless areas adjacent to or connected with existing wilderness areas would be recommended for wilderness in order to enlarge existing wildernesses and consolidate their boundaries.

Replacing off-site species, thinning overstocked, regenerating mature stands, and restoring fire-dependent and fire-associated communities would improve the health of forest vegetation. Where appropriate and consistent with the values for which the forest is being managed, risks to forests from wildfire, insect and disease damage, and non-native or non-native invasive plants would be reduced.

The rare communities found on national forest lands would be protected or restored. All existing special management areas would continue their existing management direction. Additional areas may be identified for special management land allocations.

All rivers eligible for consideration as wild and scenic rivers would be managed to protect their "outstandingly remarkable values."

A minimum transportation system would be available that improves access for forest road users while protecting forest resources. Generally, access will be limited to those areas that can be accessed by maintaining or reconstructing existing system roads, or through the construction of temporary roads. New permanent roads would only be constructed in a few situations.

The Chattooga River watershed will be managed to emphasize recreation in association with the Chattooga Wild and Scenic River Corridor; maintenance of roadless values; dispersed recreation opportunities; and improved water quality.

Mineral exploration or development will be compatible with the desired condition of the appropriate management prescriptions or management areas.

Changes in Alternative I between Draft and Final

After the release of the Final Environmental Impact Statement, many changes to Alternative I were made to respond to public comments and improve the management direction. Important changes are the following:

:

1. Riparian prescription (Management Prescription 11) was modified to clarify the direction for the determination of riparian corridors during implementation. Minimum width slope classes were changed to 0-30% and the riparian acres were reestimated.

2. Added a goal, objective and standard to address the issue of instream flows.

3. Added two new parcels of land which have recently been purchased, one on the Andrew Picken's district with the other on the Enoree district.

4. Updated the management direction on the Chattooga River Corridor in order to incorporate Amendment #14 and be consistent with the Chattoahoochee and Nantahala Forests. This is reflected in desired conditions, and standards in management prescriptions 2A, 2A1, 2A2, and 2A3. Additional management direction was also added to the Chattooga River Watershed in Chapter 4 of the plan in terms of desired conditions.

5. Turkey and Stevens creek are no longer recommended for wild and scenic river designation since the suitability analysis was not completed. We defined an objective in the Forest plan to complete this analysis within 5 years. These areas are now allocated to management prescription 4D.

6. Additional goal, objective and standards where added to chapter 2 of the Forest plan to protect the outstandingly remarkable values of the 8 rivers that are presently eligible for Wild and Scenic river designation.

7. Objectives 7.07 through 7.10 for fire dependent communities in the draft Forest Plan, have been combined into one objective and moved under goal 20.

8. Mineral leasing and restrictions to mineral development through no surface occupancy and controlled surface occupancy are now defined in the glossary. We have also added an appendix to the Forest Plan to explain how a mining proposal is evaluated at the project level.

9. Desired conditions for the four management areas in Chapter 4 of the Forest Plan have been expanded.

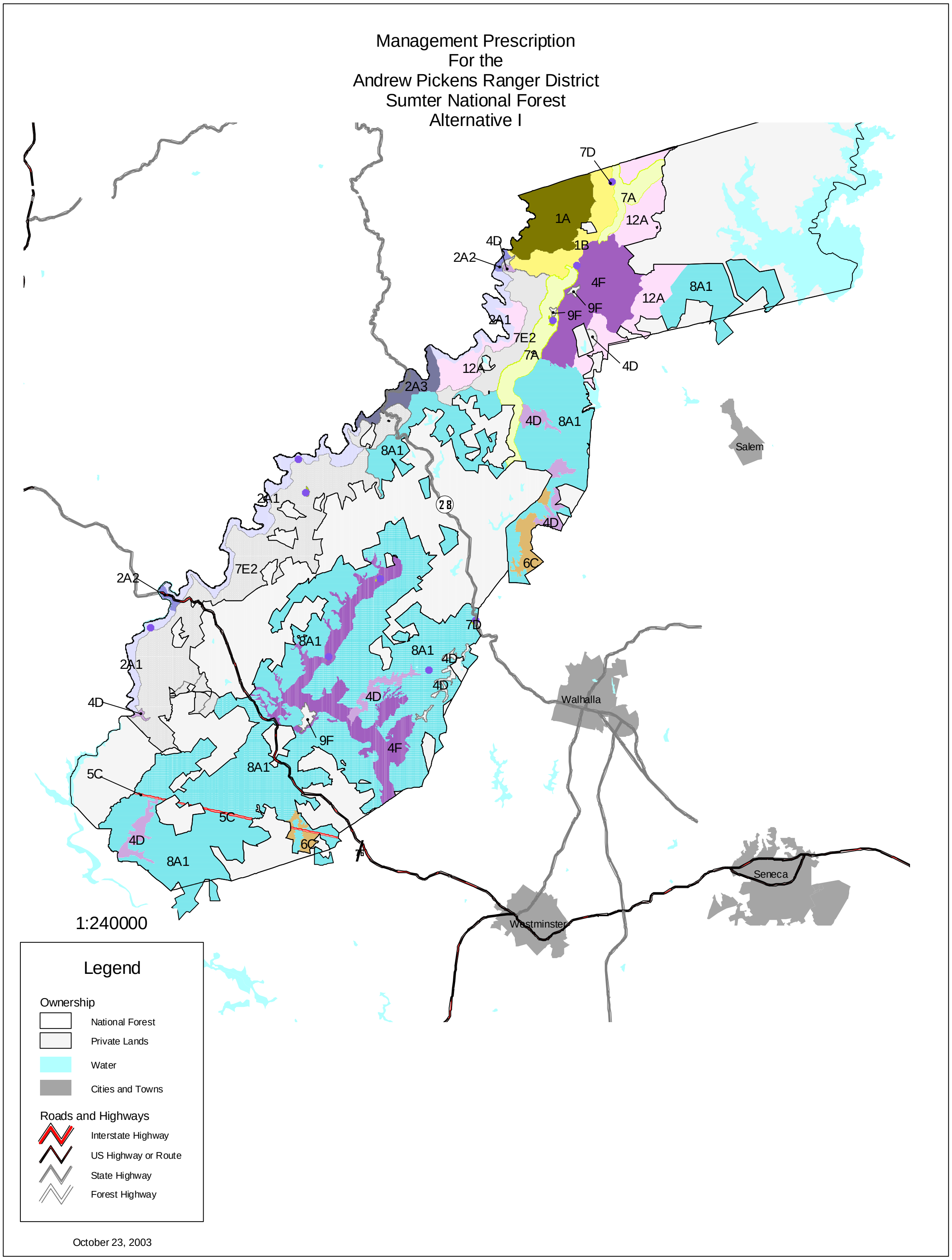
10. Updated the Management Indicator Species.

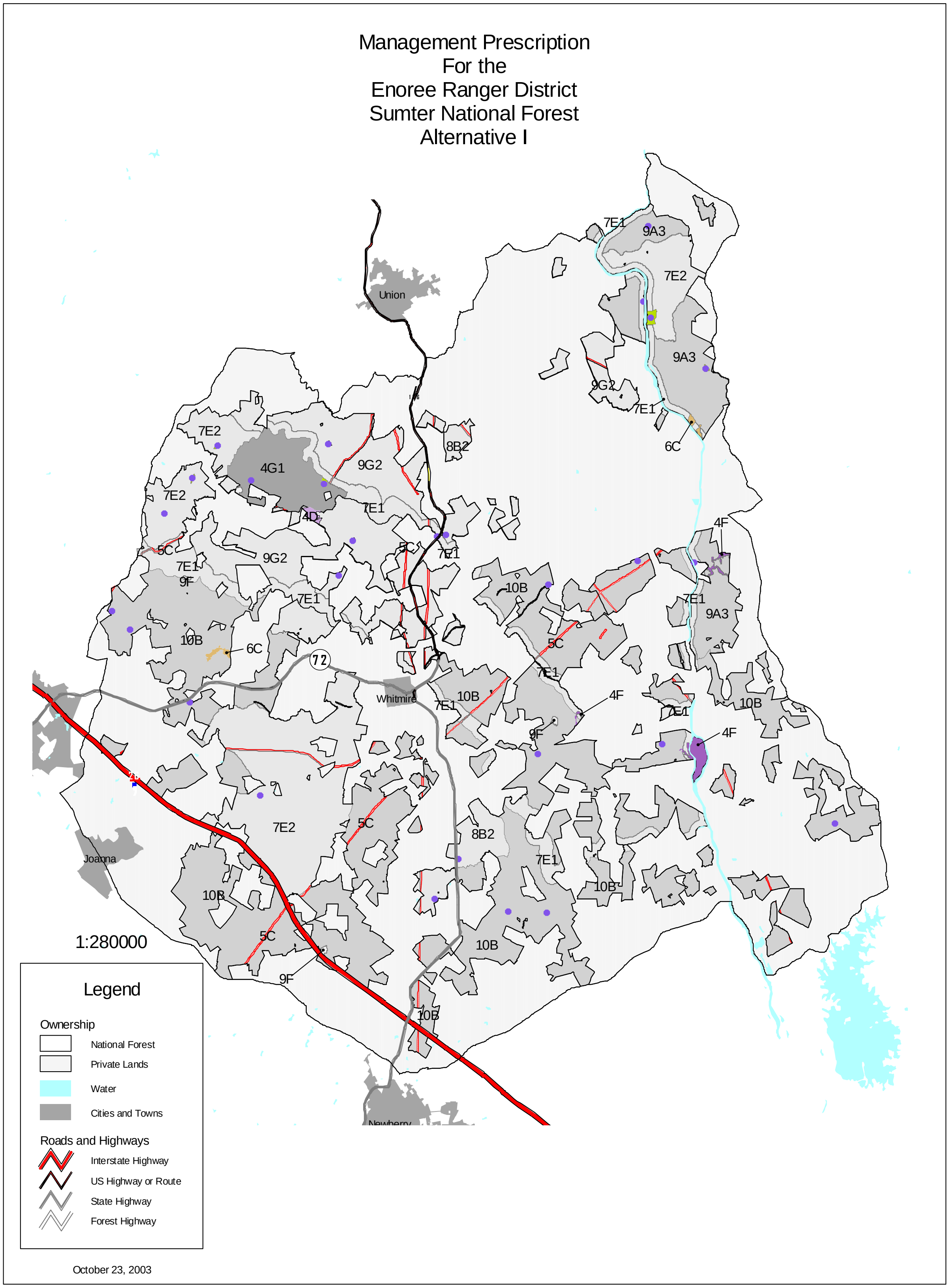
11. Updated the monitoring elements in Appendix E of the Forest Plan to better address the Forest Plan objectives.

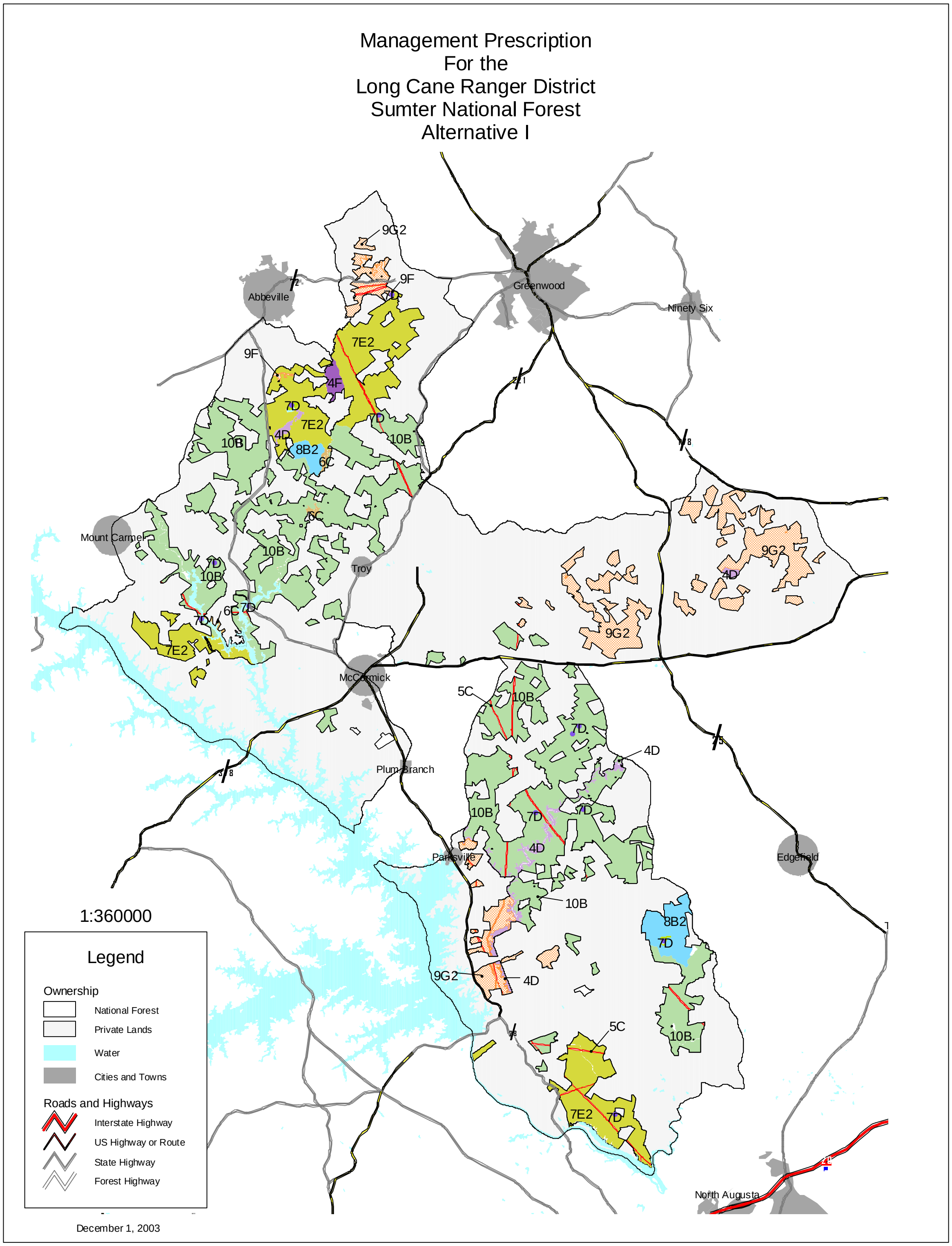
12. Updated and moved the list of research needs in Appendix G to Chapter 5 of the Forest Plan.

13. Changed management prescriptions 7A (Scenic Byway) and 2A3 (Designated Recreation River) to unsuitable for timber production.

14. Estimated ASQ and LTSY again by rerunning the Spectrum model.


Management Prescription
For the
Andrew Pickens Ranger District
Sumter National Forest
Alternative I
7D
7A
12A
1A
1B
4D
2A2
4F
9F
8A1
2A1
7E2
2A3
Salem
28
4D
6C
5C
Walhalla
Seneca
Westminster
1:240000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003


Management Prescription
For the
Enoree Ranger District
Sumter National Forest
Alternative I
Union
Whitmire
Joanna
Newberry
72
1:280000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003
7E1
9A3
7E2
9G2
6C
7E2
4G1
9G2
8B2
4D
7E1
5C
9G2
7E1
9F
10B
6C
7E1
10B
4F
10B
7E1
9F
7E2
5C
8B2
7E1
10B
10B
5C
9F
10B
10B


Management Prescription
For the
Long Cane Ranger District
Sumter National Forest
Alternative I
1:360000
Legend
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
December 1, 2003
Abbeville
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
Plum Branch
Parksville
Edgefield
North Augusta
9G2
9F
7E2
4F
7D
4D
8B2
6C
10B
5C

COMPARISON OF ALTERNATIVES

This section compares the management alternatives from several different perspectives. The acreage allocated to each management prescription for each alternative is shown. The issues identified in Chapter 1 are discussed in detail, and the impact of each alternative on the issue is summarized.

Management Prescription Acres by Alternative

Table 2-1 provides a description of the management prescriptions. Table 2-2 shows the Sumter National Forest acres that would be allocated to each management prescription for each alternative.

Table 2-1 Management Prescription Titles

Management Rx	Management Prescription Title
1A	Designated Wilderness/ Wilderness Study
1B	Recommended Wilderness Study
2A1	Wild River
2A2	Scenic River
2A3	Recreational River
2B1	Eligible Wild River prior to Designation
2B2	Eligible Scenic River prior to Designation
2B3	Eligible Recreational River prior to Designation
4D	Botanical - Zoological Areas
4F	Scenic Areas
4G1	Experimental Forest
5A	Administrative Areas
5B	Communication Sites
5C	Utility Corridors
6A	Natural Process Emphasis
6B	Areas Managed to Restore/Maintain Old-Growth Characteristics
6C	Old-Growth Areas Managed with a Mix of Natural Processes and Restoration Activities
6D	Core Areas of Old Growth surrounded by Areas with Extended Forest Rotations
6E	Core Areas of Old Growth surrounded by Areas under Uneven-Aged Management
7A	Scenic Byway Corridor
7C	OHV Use
7D	Concentrated Recreation Zone
7E1	Dispersed Recreation
7E2	Dispersed Recreation with Vegetation Management
8A1	Mix of Successional Forest Habitats
8A2	Area-Sensitive Mid- to Late-Successional Forest Habitats
8B2	Woodland and Grassland Savanna Habitats
8C	Black Bear Habitat Management
8D	Red-Cockaded Woodpecker Habitat Management
9A3	Watershed Restoration
9A4	Aquatic Habitat Watersheds
9E	Maintenance and Restoration of Pine and Pine-Oak Forests
9F	Rare Communities
9G2	Maintenance and Restoration of Pine and Pine-Oak Forests
9H	Management and Restoration of Plant Associations in the Chattooga River Waters
10B	High Quality Forest Products
11	Riparian Corridors
12A	Remote Backcountry Recreation - Few Roads
12B	Remote Backcountry Recreation - Non-Motorized

Table 2-2 Management Prescription Acres by Alternative

	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Management Rx							
1A	2,855	2,855	2,855	2,855	2,855	2,855	2,855
1B	7,638	7,068	2,106	5,083	2,281	6,293	1,982
2A1	3,290	2,511	3,290	3,290	3,275	3,290	3,290
2A2	224	202	202	72	161	202	224
2A3	1,030	1,030	1,030	1,157	1,030	1,030	1,030
2B1	1,372	2,500	1,372	2,536		1,206	
2B2	4,366	8,790	6,025	5,957			
2B3	204	2,071	2,032	204			
4D	3,931	3,171	2,917	4,410	1,557	4,953	4,399
4F	1,284	2,328	4,978	2,341	8,642	5,711	10,020
4G1	4,862	4,862	4,862	4,862	4,862	4,862	4,862
5C	2,912	2,919	2,906	2,888	2,971	2,888	2,948
6A						33,444	
6B		13,046		16,020		25,272	
6C	1,399	21,148	1,386	7,241		1,564	1,640
6D		5,844		14,479		34,958	
6E						45,361	
7A							3,044
7C	3,485			3,485			
7D	558	584	584	569	727	555	605
7E1					1,180		12,575
7E2	71,003			74,854			61,938
8A1				28,252	25,973		41,544
8A2		6,963					
8B2		44,581		143,416		769	8,320
8C		7,792					
8D					716		
9A3		46,900				39,002	11,360
9A4						39,248	
9E		16,317					
9F	547	311	737	521		513	916
9G2		119,474				55,467	43,080
9H		37,821					
10B	238,048		322,595		304,435	51,648	139,528
11							
12A	12,079			35,387			4,929
12B			1,210	1,210			
Water	1,761	1,761	1,761	1,761	1,761	1,761	1,761
Total	362,850	362,850	362,850	362,850	362,850	362,850	362,850

Includes 285 Acres of RX 5A (Administrative Areas) ; 4 acres of RX 5B (Communication Sites); approximately 63,000 acres of RX 11(Riparian Corridors) for Alt. I, 67,000 acres for Alt. A, B, D, E, G, and approximately 13,400 acres for Alt. F.

Includes 2240 Acres of Non-Forest Lands

Comparison of Alternatives by Issue

Issue 1 - Terrestrial Plants and Animals and Their Associated Habitats

Public comments reflect a broad array of interests and concerns revolving around "biodiversity." This term broadly refers to the distribution, variety, and abundance of plant and animal communities, ecosystems, and individual species. Some people contend biodiversity objectives should be achieved through active multiple-use management, while others contend biodiversity can only be achieved through passive management emphasizing "natural" processes.

The revised LMP considers the distribution and abundance of communities across the landscape. Opinions conflict regarding the potential effects of management activities on species requiring large tracts of contiguous forested land. Some people contend these areas should be left "undisturbed," while others contend that these areas should be managed to provide a variety of successional classes. Specific comments were made supporting the establishment of "corridors" that link patches of suitable habitat. Several species groups and individual species were named: black bear, ruffed grouse, salamanders, and Neotropical migratory birds like the cerulean warbler.

Questions have not been resolved over the issue of minimum area-size requirements of early successional habitat—whether these areas should be clustered or distributed as evenly as possible over the landscape—and whether or not these areas are adequately provided for on private lands.

There is also a question of scale: To what extent should wildlife habitat goals and opportunities be developed within the context of neighboring public and private lands? Should existing habitat conditions from these non-NFS lands be considered in developing the goals for NFS lands, or should only NFS lands be considered?

Other comments received relate to forest composition and the desire for increases in the hardwood and mixed forest cover types. The LMP would establish habitat management objectives for terrestrial habitat groups and the restoration management direction needed to achieve those objectives.

In addressing this issue, management activities would strive to:

- Maintain or increase habitats where species need large, contiguous forested landscapes and where the management of national forest lands can make a difference in their populations and viability.

- Provide habitat conditions necessary to maintain viable populations of all species native to the planning area and to support desirable levels of selected species (e.g., species with special habitat needs, locally rare species, species commonly trapped/hunted, or species of special interest).

Table 2-3 shows the comparison of Issue 1 by alternative.

TABLE 2-3. ISSUE 1 - TERRESTRIAL PLANTS AND ANIMALS AND THEIR ASSOCIATED HABITATS

Alternative/Units of Comparison	A	B	D	E	F	G	I
Successional Forest Habitats	**Percent of Forested Acres**						
Early Successional Habitat - 1st Decade	10.9	4.5	9.8	6.5	12.6	4.5	7.4
Early Successional Habitat - 5th Decade	8.4	6.4	8.8	7.2	11.8	4.5	8.0
Mid- to Late-Successional Habitat - 1st Decade	69	78	70	73	67	75	71
Mid- to Late-Successional Habitat - 5th Decade	64	70	63	76	54	83	67
Late Successional Habitat - 1st Decade	37	46	39	42	35	43	41
Late Successional Habitat - 5th Decade	27	41	24	43	12	56	34
	Percent of Forested Acres						
Mid- to Late-Successional Mesic Deciduous(non-Oak) Forests - 1st Decade	9.5	9.2	9.5	9.4	9.4	8.8	9.0
Mid- to Late-Successional Mesic Deciduous (non-Oak) Forests - 5th Decade	7.5	8.7	7.2	8.8	2.9	9.4	8.5
Mid- to Late-Successional Oak, Oak-Pine Forests - 1st Decade	14.6	13.4	13.9	14.8	13.6	15.2	14.9
Mid- to Late-Successional Oak, Oak-Pine Forests - 5th Decade	8.0	11.2	6.8	11.3	4.6	15.2	10.8
Mid- to Late-Successional Pine, Pine-Oak Forests - 1st Decade	42	49	44	46	41	48	44
Mid- to Late-Successional Pine, Pine-Oak Forests - 5th Decade	46	53	46	53	44	55	44
Permanent Openings, Old Fields, Linear Strips	**Acres in Thousands**						
Acres in Mgt. Prescription Allowing New Permanent Openings	317	69	326	253	335	54	251
MIS – Community Indicators	**Trends**						
Hooded warbler	+	=	+	+	+	=	+
Scarlet tanager	+	=	=	+	=	+	+
Pine warbler	-	+	=	=	-	+	-
Acadian flycatcher	+	+	+	+	=	+	+
Prairie warbler	+	=	+	+	+	=	+
Pileated woodpecker	+	+	+	+	+	+	+
Field Sparrow	+	+	+	+	=	=	+
Swainson's Warbler	=	+	=	+	-	+	+
American Woodcock	+	-	+	=	+	-	+
Brown-headed nuthatch	=	+	=	+	=	=	+

Issue 2 - Threatened, Endangered, and Sensitive/Locally Rare Species

The national forests of the Southern Appalachians provide potential and occupied habitat for numerous threatened and endangered species. Legal mandates require national forests to manage habitats at levels that accomplish the recovery of federally listed species and maintain viable populations for sensitive (PETS) species as important components of diverse, functional ecosystems. The LMP revisions will determine habitat objectives or forestwide standards needed to protect or restore existing species and habitats and implement recovery objectives that have been established for threatened and endangered species by the U.S. Fish and Wildlife Service (USFWS).

The concern includes determining where no habitat management is needed and where national forests should manage to create conditions suitable for PETS species. There could also be opportunities to restore habitat conditions that could allow for the reintroduction of particular species.

Management strategies for PETS species become complex in light of the factors previously mentioned and because of the scale questions that affect the national forests. The range of some species covers multiple forests, and their management strategies need to be coordinated between forests. Other species occur only on the periphery of National Forest System lands and actions taken on national forest lands will only minimally influence their recovery. In the case of aquatic species where conservation measures occur on public lands, activities that occur on other ownerships within a watershed could prevent improvement of habitat quality and expansion of suitable habitat; therefore, movement toward recovery would not be noticeable.

Concerns have also been expressed for those species that are “locally rare.” These are species that are not “rare” within their biological range but are “rare” on a national forest or in a particular state. Concerns about how these species and their habitats will be managed involve coordination with State Natural Heritage Programs and State wildlife agencies.

In addressing this issue, management activities would strive to:

- Conserve and recover threatened, endangered, and sensitive species and their habitats.

Table 2-4 shows the comparison of Issue 2 by alternative. This table shows/describes the number of species/habitat combinations ranked as very high, high, and moderately high risk to species viability on the Sumter National Forest, the Andrew Pickens and Piedmont Districts combined. This information was derived from a species viability analysis conducted for this Forest Plan.

TABLE 2-4. ISSUE 2 – THREATENED, ENDANGERED, AND SENSITIVE/LOCALLY RARE SPECIES

Alternative/Units of Comparison	A	B	D	E	F	G	I
Total Terrestrial Species Status Categories	**Number of Species/Habitat Relationships**						
Species/Habitat Relationships Rated as Very High Risk	49	50	49	50	68	51	49
Species/Habitat Relationships Rated as High Risk	79	79	79	80	75	81	79
Species/Habitat Relationships Rated as Moderately High Risk	120	122	120	123	117	122	120
Total	248	251	248	253	260	254	248
Aquatic Species Viability	**Number of Species/Number of Watersheds**						
Low Risk	2/4	2/4	2/4	2/4	2/4	2/4	2/4
Moderate Risk, FS May Positively Influence	5/13	5/13	5/13	5/13	5/13	5/13	5/13
High Risk, Little Opportunity for FS Influence	3/18	3/18	3/18	3/18	3/18	3/18	3/18
High Risk, FS May Positively Influence	0	0	0	0	0	0	0
Very High Risk, Little Opportunity for FS Influence	0	0	0	0	0	0	0

Issue 3 – Old Growth

The public expressed concerns and a variety of viewpoints about old-growth forests on public lands. Some concerns reflected the need for more of a focus on old growth than what is included in the existing LMP. Others commented that the spatial distribution and linkages of old-growth patches were important, that old-growth communities were under-represented on private lands, and that the national forests provided the best opportunity to provide for these communities. Comments were made that old-growth communities are currently underrepresented on national forests, and timber harvest activities are likely to reduce them further. Others stated that "protecting" old growth was an inappropriate underutilization of resources: old growth is adequately represented and protected in current LMP through wilderness, lands identified as unsuitable for timber production, and by relatively low harvest levels and long rotations on lands allocated for wood production.

People associate many values with old growth; some values are compatible, others present conflict. Old growth provides both biological and social values. Old-growth communities provide large den trees for wildlife species such as black bear, large snags for birds and cavity nesters, and large cover logs for other wildlife. Ecologically, old growth provides elements for biologic richness, gene conservation, and riparian area enhancement. Old-growth areas provide certain recreational experiences, research

opportunities, and educational study. Other areas have associated historical, cultural, and spiritual values (e.g., “just knowing” old-growth areas exist). Old-growth areas are a source of large-diameter, high-value hardwoods, which are limited in supply and in high demand for such products as furniture and construction finish-work. Some people say that each old-growth community type provides its own unique set of values.

Another concern is about how old growth should be managed, maintained, or restored. Many people state that old-growth areas should be protected or “preserved” and that there should be no harvesting within these areas. Another view is that old growth should be a self-perpetuating state where human intervention is unnecessary. Some expressed a concept of different levels of old-growth management, including undisturbed “core” areas with more actively managed “buffers” of old growth around them. Others say that insect and disease risk can be relatively high in old-growth stands and could (for some community types) threaten the retention of those stands as old growth. There is concern that fire exclusion could favor a buildup of fire-intolerant, but shade-tolerant, species that could eventually replace the original old-growth type. This view is that active management, including timber harvest and prescribed fire, could be used to accelerate the development of old-growth attributes. Given the dynamic nature of forests, some believe there is a need to plan for replacement of old growth. Others have expressed concern about fragmentation of old growth that might result from moving old growth around and not having designated old-growth areas. Some expressed concerns about costs of managing old growth and the possibility of reduced wood production and timber values.

The Draft 1995 RPA Program discusses the need for “old-growth management areas” and LMP revisions would address what is a desirable distribution and representation of old-growth communities. The LMP would provide management direction for areas allocated to old growth as well as which lands are suitable or unsuitable for timber production. Additional small patches of existing old growth will be managed to protect those characteristics, as they are encountered on the landscape under each alternative.

In addressing this issue, management activities would strive to accomplish:

- A variety of large, medium, and small old-growth patches will be managed (through restoration, protection, or maintenance activities) to meet biological and social needs. These patches could include stands of either "existing old growth" or "future old growth."

Table 2-5 shows the comparison of Issue 3 by alternative. This table shows acres of future old growth allocated, including old-growth compatible prescriptions, on the Sumter National Forest.

TABLE 2-5. ISSUE 3 – OLD GROWTH							
Alternative/Units of Comparison	**A**	**B**	**D**	**E**	**F**	**G**	**I**
Old Growth	**Acres in Thousands**						
Acres of Allocated Old Growth (Rx 6's)	1,399	40,038	1,386	37,740	0	140,599	1,640
Total Acres Future Old Growth	87,940	116,260	77,155	121,100	17,520	148,050	95,766

Issue 4 - Riparian Area Management, Water Quality, and Aquatic Habitats

Although water supplies in the South are abundant, expanding urbanization and development are creating increased demands and impacts on the waters of the South. According to the SAA, two-thirds of reported water quality impacts are due to non-point sources. Soil erosion and stream sedimentation—as well as nutrient, chemical, and bacterial contamination—can result directly or indirectly from land uses. Beneficial uses of water are often undesirably and unintentionally affected by water quality degradation created by land uses. Growth in South Carolina is expanding to rural areas, and an increasing percentage of the landscape is being affected, including some watersheds with Sumter National Forest lands.

The SAA also indicates that forestry practices have a low potential for impact on aquatic resources and that agricultural runoff, stormwater discharges, roads, urban/suburban development, dams and mining have caused the largest alterations in waters of the region. However, the SAA indicates that the impacts on water are greatest for land uses and activities near streams. (Some examples of this include overused campsites and lack of maintenance on roads and trails.) Water quality impacts also increase with the proportion of a watershed that is disturbed. In addition, many eroded and unproductive areas acquired under the Weeks Law were destined to become National Forests. In South Carolina, a long legacy of land use abuses resulted in severe surface erosion, channel adjustment and water quality effects that continue to some degree.

National forests were originally established, in part, to secure favorable water flows. The 1972 Clean Water Act requires states to establish water quality standards for streams and water bodies, including designation of beneficial uses, criteria to protect beneficial uses, and an antidegradation policy. The Forest Service must meet, or exceed, these State procedural and substantive requirements for water quality on the national forests. National forest management should protect the beneficial uses, namely cold water, cool water, or warm water fisheries; recreation and municipal water supplies; habitats for other indigenous aquatic life; and aquatic PETS species.

Some people have expressed concern about national forest management effects on water quality, specifically about the effects of timber harvesting, recreational uses, and road building on water and in-stream habitats. Streamside protection measures, harvesting practices, in-stream habitat management, and water quality monitoring methods in the existing LMP would be reevaluated. There are also concerns about off-forest effects on the water quality and aquatic habitats within the national forests. In some cases, water quality and aquatic habitat protection and improvement would require the support and cooperation of the public, industry, or neighbors within a watershed, depending on the prevalent land uses. The Sumter National Forest intends to limit effects of activities by ensuring quality planning and implementation of projects, and be a willing partner to help address water quality and aquatic habitat issues, especially within watersheds with National Forest ownership.

The maintenance and/or enhancement of aquatic habitats are also necessary to maintain healthy viable populations of fish, mussels, amphibians and other aquatic organisms. The protection of aquatic habitats for threatened, endangered, sensitive, game, and non-game species is necessary for the survival of these species. The desired conditions for aquatic habitats would also consider the conditions necessary to increase recreational fishing opportunities.

Riparian areas have value to many users for a variety of purposes. Habitats for a multitude of plant and animal species and most of the highest valued recreation sites reside in the riparian zone. Riparian areas are often the most productive sites for growing high-quality wood products. Competition for this "rich" resource is strong, making the issue an important one to almost every user group, visitor, and manager. This issue also relates to an area that was emphasized in the 1995 Draft RPA.

The SAA identified 1.5 million acres of seeps, springs, and streamside areas in forested cover, of which national forests contain around 219,000 acres. The future quality of these areas and their associated habitats is uncertain and would depend on the combined effects of public and private management activities, as well the effects from current and future threats such as the hemlock wooly adelgid. Since then, we have agreed to limit activities within the riparian corridor that includes a buffer along streams and waterbodies, floodplains, wetlands, bottomland hardwoods and mesic terraces.

Riparian areas cannot be managed as an isolated resource. Given the interrelated nature of riparian, aquatic, and upland ecosystems, the effects of most forms of management will need to be examined within the context of headwater drainages, perennial streams to entire watersheds.

The revised LMP will provide direction for the management of riparian areas and the habitats they contain. The LMP will address how timber,, road, wildlife, fishery, watershed restoration, mining, and recreational pursuits of many types can be provided for in a way that would not impair aquatic and riparian ecosystems. The LMP will ensure that the appropriate standards and land-use allocations are in place to meet or exceed State water quality standards and desired conditions for aquatic habitats.

In addressing this issue, management activities would strive to accomplish:

- Watersheds managed (and where necessary, restored) to provide resilient and stable conditions to ensure the quality and quantity of water necessary to protect ecological functions and support intended beneficial water uses.
- Riparian ecosystems, wetlands, and aquatic systems managed (and where necessary, restored) to protect and maintain their soil, water, vegetation, fish, and wildlife associated resources.

Table 2-6 shows the comparison of Issue 4 by alternative.

TABLE 2-6. ISSUE 4 – RIPARIAN AREA MANAGEMENT, WATER QUALITY, AND AQUATIC HABITATS

Alternatives/Units of Comparison	A	B	D	E	F	G	I
Soil and Water	Percent Increase						
Average percent increase in sediment yields from FS activities over existing levels across 28 watersheds	1.5	1.5	1.5	1.3	1.9	0.7	1.5
MI – Aquatic Communities	Trends						
Cold water aquatic communities	+	+	+	+	+	+	+
Cool water aquatic communities	+	+	+	+	+	+	+
Warm water aquatic communities	+	+	+	+	+	+	+
Acres in Watershed Restoration Prescriptons	Acres in Thousands						
Acres Allocated to Mgt. Prescriptions 9As	0	46.9	0	0	0	39.0	11.4

Issue 5 – Wood Products

Some people feel that national forests are public lands that should be set aside, either for providing forest-related values other than timber, or as a reserve of timber. In contrast, others feel the purpose of national forests is to support the local or regional wood processing facilities and contribute to local economies; that national forests should emphasize utilizing the current forest growth capabilities or provide a community-based balance between wood production and recreation benefits. Still others see that the values they are concerned with, such as wildlife game species, can be best provided through habitat manipulation that includes the production of wood products. With recent policy changes of the Forest Service toward more ecology-based management, some people question whether the wood product role of national forests has changed. Others point out

that the national forests still need to be managed to provide for multiple uses, including wood products.

Considerable concern has been expressed about where sustained-yield production of wood products will occur. Will there be any removal of wood products from certain areas such as riparian zones, wetland, special areas, or unique habitats? Some people state that timber harvesting is not needed in all areas, and that it causes too much damage to the environment. Other people state that the concerns about effects of production of wood products on the environment can be dealt with through LMP standards and that most areas should be kept available.

Other concerns were expressed about how much production of wood products will be expected from National Forest System lands. Some individuals express the need to adapt the allowable sale quantity (ASQ) objectives to the demands of the local or market area. Product sizes and mixes are sometimes a concern to local wood product consuming industries. Other people are also looking more to the South as a source of wood products nationally, given the decreased availability in other regions of the country. Additionally, the national forests in the Southern Appalachians hold a large share of the high-grade oak sawtimber and other high-quality hardwoods, which are in short supply but high demand.

Some people say there is a conflict between production of wood products from public lands and the wood market opportunities for private landowners. Other people are concerned that reduced production of wood products will lead to “unhealthy” aging of the national forests with increased pest problems that could affect both public and private lands. Some individuals regard production of wood products as a way to lower insect and disease risk and fire hazards. On the other hand, other people see opportunities to utilize trees being killed by insects and disease outbreaks. Still others are concerned that any production levels would cause conflicts and that if any wood products are produced they should be by-products of meeting other management needs. Some people question any wood product removal from national forests.

Concerns about how much and where wood products would be removed from National Forest System lands often relate to the practices that are used and the cost-effectiveness of production of wood products. Below-cost production of wood products (of which there is no agreed-upon definition) is a concern for some people. There are people who would like all below-cost timber sales to stop because they view this as subsidizing the wood products industry. There are others who want to be sure that, if below-cost sales are offered, either the resulting benefits to other resources justify the below-cost situation or the silvicultural practice(s) is the best way to meet the desired resource objectives.

Concerns are often expressed about the regeneration methods used to produce the wood products (e.g., clear cutting and single tree selection). Many people have commented that wood products should be removed only if it is done without requiring construction of new roads. Some have expressed concerns about the environmental effects of forest-type conversion from hardwood to pine and the size of harvest areas and frequency of harvests.

The LMP revisions would determine what lands would be suitable for sustained yield of wood products. This determination of suitable forestlands includes using the production of wood products as a means to achieve LMP resource objectives in a way that considers cost-effectiveness and economic efficiency.

In addressing this issue, management activities would strive to accomplish:

- Determine where forest management activities are needed and appropriate to achieve the desired composition, structure, and function of forest ecosystems; a result of such activities will also be to provide a sustainable supply of wood products for local needs.
- Provide supplies of wood products when the Forest Service is in a unique position to make an impact on meeting the demand for those products.

Table 2-7 shows the comparison of Issue 5 by alternative.

TABLE 2-7. ISSUE 5 – WOOD PRODUCTS

Alternative/ Units of Comparison	A	B	D	E	F	G	I
Timber Management	Acres in Thousands						
Land Classified as Suitable for Timber Production	260,885	235,008	270,134	212,275	338,258	124,557	259,313
	MMCF / MMBF						
Allowable Sale Quantity (First Decade)	156/858	109/600	156/858	113/622	182/1000	79/435	139/763
Timber Sale Program Quantity (Total First Decade	156/858	109/600	156/858	113/622	182/1000	79/435	139/763
Timber Sale Program Quantity (Total Fifth Decade)	156/858	109/600	156/858	113/622	182/1000	79/435	139/763

Issue 6 - Aesthetics/Scenery Management

The LMP revisions must determine goals and objectives for the management of National Forest System lands. Some people pointed out that natural-appearing landscapes of high-quality scenery are one of the main reasons tourists and recreationists come to the Southern Appalachians. Scenic landscapes help to determine the success of recreation and tourism. Opinions vary as to the existing scenic condition. Some see the need for enhancement, restoration, and for increased opportunities to provide older and larger trees. Some think that a predominantly natural-appearing, non-industrial-looking forest

landscape character should be emphasized; and that certain areas of the national forests—such as travel and trail corridors, important view sheds, and other places with recreation use—should provide a higher level of scenery. Some people also commented that management for hardwoods should be increased because hardwoods tend to enhance the scenic quality of an area.

Another concern is with the increasing levels of private development on the edge of the national forests and the desires of these private landowners for high-quality scenery on the adjacent National Forest System lands.

Comments were made that public preferences for scenic quality should be evaluated and that aesthetic (scenic integrity) objectives should be established. Some people state that the existing Forest Plans allow for too much scenic degradation. To them the high visual impact management practices and uses—such as clear cutting and the building of roads, power lines, and electronic sites—are too dominant. Some people suggested that selecting low-impact practices and emulating natural processes would better manage the scenery of the national forests. Other individuals mentioned that while harvesting wood products does tend to cause a visual disruption, this effect is only temporary and that the harvest method used would be whatever is needed to meet resource objectives. Some commented that scenic quality would be restored through the use of salvage timber harvesting following disturbances like fires and insect outbreaks. Others said that the Forest Service should identify and implement methods that would reduce the visual impact of timber harvest so that harvesting can continue to be used as a management tool.

In addressing this issue, management activities would strive to accomplish:

- Protection and enhancement of the scenic and aesthetic values of national forest lands in the Southern Appalachians.
- Management of national forests to provide a variety of landscape character themes with the predominant themes being natural appearing, natural evolving, and variations of these themes.

Table 2-8 shows the comparison of Issue 6 by alternative. This table shows/describes Scenic Integrity Objectives. The acres in each SIO class, ranging from very high (VH – unaltered) to low (L – moderately altered), were then totaled to develop the following range.

TABLE 2-8. ISSUE 6 – AESTHETICS/SCENERY MANAGEMENT							
Alternative/Units of Comparison	**A**	**B**	**D**	**E**	**F**	**G**	**I**
Scenic Integrity Objectives	**Total Forest Acres**						
Very High	15,600	16,500	14,800	16,300	20,200	42,300	15,600
High	47,800	43,400	40,600	67,600	27,000	33,000	47,500
Moderate	110,900	131,600	67,500	131,800	22,400	198,000	112,800
Low	182,700	165,500	234,100	141,300	287,400	83,700	181,100

Issue 7 - Recreation Opportunities/Experiences

National forests provide a variety of dispersed and developed recreational opportunities. Forest Plan revisions would consider actions that are responsive to a wide array of forest visitors and the variety of experiences they desire. The economic benefits of these recreation opportunities to local communities and local commercial outfitters would be considered.

In the SAA area, for example, currently only around eight percent of the land (including the Great Smoky Mountains National Park (GSMNP)) can provide "remote" recreation settings. Many people feel that national forests should be the principle provider of these remote experiences. The Draft 1995 RPA Program reported that recreation demand levels would increase significantly on national forests, making it increasingly difficult to manage recreation sites at an acceptable quality standard. (The last RPA program was developed in 1995. Currently the Forest Service Strategic Plan (2000 Revision) provides broad overarching national guidance for forest planning and national objectives for the agency as required by the Government Performance and Results Act. All of the alternatives in this EIS incorporate these broad strategic objectives.)

People are using trails today for much more than backpacking. Mountain biking, horseback riding, and OHVs are all used on national forest trails. Due to the limited sources of supply, these trails are often congested and have become sources of conflict between users. In many cases, there is a strong interest in increasing the trail networks for all these uses. Increases in the trail miles would increase trail use opportunities and reduce the congestion on existing trails. The challenge would be with developing a trail system that recognizes conflicting uses and minimizes resource damage. Of particular concern is a policy for managing OHV use. Trails of national interest and trail systems that connect adjacent national forests (e.g., the Appalachian Trail) would have coordinated management direction.

Congestion in recreation use tends to occur on the shores of lakes and streams because these settings are in high demand. Some users are concerned with the lack of trailhead facilities. In those areas where developed sites and recreation facilities are congested, and the facilities and the resources are being damaged from overuse, opportunities for providing additional facilities need to be explored. Comments were made that the Forest Service should emphasize providing for recreational opportunities that are not generally available on private land. Other comments have been made to the effect that before the Forest Service builds new facilities, there would be an emphasis on maintaining and upgrading the existing facilities.

For some people, the quality of the recreation experience often goes down as the number of users goes up. Additional user control may become necessary to limit the number of people in overcrowded areas or in biologically sensitive areas. Some people are also concerned that timber harvesting activities or concentrated recreational use may result in a reduction of habitats for various huntable wildlife species, or a reduction in water quality that will affect fishing opportunities. Others state that timber harvesting has a beneficial effect on huntable wildlife.

In addressing this issue, management activities would strive to accomplish:

- Provide a spectrum of high quality, nature-based recreation settings and opportunities that are not widely available on non-Federal lands.
- Strive to meet the following recreation needs within the capabilities of the land:
    - Hiking, biking, and equestrian trail systems, especially in non-motorized settings with high quality landscapes. (Provide separate-use trails where necessary to reduce user conflicts or to improve the quality of recreation experiences.)
    - Designated OHV routes (which will occur primarily in RN1 settings).
    - The high priority improvements, expansions, or additions of facilities providing developed recreation opportunities.
    - Hunting, fishing, and non-consumptive wildlife opportunities.
    - Improved interpretive opportunities or other special recreation needs locally identified.
- The national forests will manage areas to provide for the "backcountry" (semi-primitive/remote) recreation experiences that are not available on other land ownerships.
- Although the opportunities for outdoor recreation are extensive and the public demand for these opportunities is seemingly endless, the Forest's capability to meet these demands is neither static nor endless. Visitor preferences can shift over time, and both changing financial limitations and environmental impacts must be considered. In order to maximize value to the public with the limited resources available, the Forest will focus on providing those recreation opportunities that are unique or of exceptional long-term value in a manner that focuses on maximizing visitor satisfaction within financial and environmental limitations.

- A goal is to provide a spectrum of high quality nature-based recreation settings and opportunities that reflect the unique or exceptional resources of the Forest and the interests of the recreating public on an environmentally sound and financially sustainable basis. Adapt management of recreation facilities and opportunities as needed to shift limited resources to those opportunities.

Table 2-9 shows the comparison of Issue 7 by alternative.

TABLE 2-9. ISSUE 7 – RECREATION OPPORTUNITIES/EXPERIENCES

Issue/Units of Comparison	A	B	D	E	F	G	I
Recreation Opportunity Spectrum	**Acres**						
Primitive (Rx's 1A and 1B)	10,493	9,923	4,961	7,938	5,136	9,148	4,837
Semi-Primitive Non-Motorized	4,462	5,011	5,872	7,036	3,275	37,940	3,290
Semi-Primitive Motorized	16,669	8,992	6,227	41,416	161	202	5,153
Roaded Natural	328,865	336,563	343,429	304,099	351,917	313,199	347,209
Rural/Urban	600	600	600	600	600	600	600
Recreation Management Allocations	**Acres**						
Acres with a Recreation Emphasis (Rx 7's)	75,047	584	584	78,908	1,907	555	78,162
Acres with a Backcountry Recreation Emphasis (Rx 12's)	12,079	0	1,210	36,597	0	0	4,929
Developed/Dispersed Recreation	**Range**						
Estimated Increase in Capacity of Developed Day Use Recreation Areas	Low	Low	Low	Low	Low	Low	Low
Estimated Increase in Capacity of Dev. Level 2 Campgrounds	Low	Low	Low	Low	Low	Low	Low
Estimated Increase in Capacity of Dev. Level 3 Campgrounds	Decrease	Low	Low	Decrease	Low	Low	Low
Estimated Increase in Capacity of Dev. Level 4 Campgrounds	High	Low	Low	High	Low	Low	Low
Estimated Increase in Hike-only Trails	Low	Low	Low	Low	Low	Low	Low
Estimated Increase in Hike and Bike Trails	High	Low	Low	High	Low	Low	High
Estimated Increase in Hike and Equestrian Trails	Low	Low	Low	Low	Low	Low	Low
Estimated Increase in Hike, Bike and Equestrian Trails	Moderate	Low	Low	Moderate	Low	Low	Moderate
Estimated Increase in Paddle Sports Trails	Low	Low	Low	Moderate	Low	Low	Low

Off-Highway Vehicle Roads and Trails	Acres						
Acres of Off-Highway Vehicle Use Areas (Rx 7C)	3,500	0	0	3,500	0	0	0
	Range						
Estimated Change in Motorized Roads and Trails	High	Low	Low	High	Low	Low	High
MIS – Demand Species	Trends						
Bobwhite quail	+	+	+	++	++	=	+
Eastern Wild Turkey	+	+	+	++	=	=	+
Black Bear	+	++	+	+	=	=	++
Hunting	Trends						
White-tailed deer	++	=	++	++	++	=	++
Wild turkey	++	=	++	++	++	=	++
Small game	++	=	++	++	++	=	++

Issue 8 - Roadless Areas and Wilderness Management

The sufficiency of the existing wildernesses continues to be debated. A wide spectrum of interest exists among the national forest community. Various alternatives in the LMP revisions would consider recommending some, all, or none of the roadless areas to Congress for wilderness designation.

Some people have indicated that all roadless areas should be recommended for wilderness designation, while others have said there is enough wilderness already and that the roadless areas should be managed to achieve other resource objectives. Comments have been received that all the areas identified in the Wilderness Society's "Mountain Treasures" should be recommended for either wilderness or some special area designation.

People have expressed concern over the fate of any roadless areas not recommended for wilderness. Some people have proposed that these areas be used to mitigate habitat fragmentation, or managed as scenic areas, or managed to provide a "remote" or "semi-primitive non-motorized" recreation experience. Others people propose that an area does not have to be labeled as "roadless" or "wilderness" in order to provide biological diversity. These people believe that in order to provide high-quality wildlife habitat, different types of disturbances are needed in order to create a variety of successional stages. Others would like to see the lands in roadless areas available for timber production.

Comments were received that even if certain areas do not meet the criteria for inclusion in the roadless area inventory, these areas should still be considered for inclusion in the wilderness system. Other individual comments indicated that the Forest Service should

consider obliterating roads within Forest Service jurisdiction in order to “create” areas that would then meet the criteria for inclusion in the roadless area inventory.

For areas that are already congressionally designated as wilderness, concerns have been expressed about how they are managed. The recommendation of any new areas to the wilderness system may also have an impact on how any existing wildernesses that are nearby are managed. These wilderness management concerns include patterns and intensities of uses, insect and disease management, fire management including the use of more management-prescribed fire, incorporating limits-of-acceptable change concepts into plan direction, and the mitigation of air pollution effects on wilderness resources. Existing wilderness standards would be reviewed to see if they are effective in achieving the desired future conditions of wilderness resources.

In addressing this issue, management activities would strive to accomplish:

- Wilderness, roadless, and other unroaded areas are managed to provide their full range of social and ecological benefits.

Tables 2-10 and 2-11 show the comparison of Issue 8 by alternative.

Table 2-10. Issue 8 – Roadless Areas and Wilderness Management

Alternative/Units of Comparison	A	B	D	E	F	G	I
Wilderness/Roadless	Acres /Percentage						
Acres of Existing Wilderness	2,856	2,856	2,856	2,856	2,856	2,856	2,856
Recommended for Designation as WSAs	7,638	7,068	2,106	5,083	2,281	6,293	1,982
Percentage of Roadless Character Maintained (of all roadless areas, including areas recommended for WSA)	99	100	50	99	49	100	100

Table 2-11. Issue 8 – Roadless Areas Recommended for WSAs

Alt.	Roadless Areas Recommended for Designation as Wilderness Study Areas
A	Ellicott Rock 1 and 2, Bee Cove
B	Ellicott Rock 1 and 2, Big Mountain and Bee Cove
D	Ellicott Rock 1 and 2
E	Ellicott Rock 1 and 2, Bee Cove
F	Ellicott Rock 1 and 2
G	Ellicott Rock 1 and 2, Big Mountain and Bee Cove
I	Ellicott Rock 1 and 2

Issue 9 - Forest Health

Forest pests threaten economic, social, and biological values. Non-native pests are increasing in number of species and expanding their ranges. Risk to national forests by both native and non-native species is increasing, as is the debate over how forest insects and diseases should be viewed. Some of the major concerns related to this issue of forest health include oak decline, dogwood anthracnose, gypsy moth, balsam woolly adelgid, hemlock woolly adelgid, southern pine beetle, and invasive non-native pest plants.

Dead, dying, or down trees are viewed by some people as evidence of poor health or lack of good stewardship. These people believe that active management can improve and may be essential for forest health. Other individuals want more natural landscapes with little or no human intervention of any kind. They recognize that tree mortality can provide desirable ecological values such as standing dead snags, down trees, and canopy gaps that provide for new growth. Some people contend that current national forest management does not address the “real” threats to forest health, such as air pollution, non-native plant and animal species, and stream sedimentation. Nearby private landowners also express concerns about possible forest pest threats to their lands from National Forest System lands.

Concerns have been expressed about the changing ecological conditions and the susceptibility to insects, diseases, and pests. Some people state that these changed conditions are the result of fire-suppression activities, the limited use of prescribed fires, and a lower level of disturbance compared with historic levels. The level of management needed to protect special areas or values, such as wilderness or certain habitats for threatened and endangered species, often creates concerns about forest pest management. There are also concerns about the use of pesticides: some indicate that it is a tool that still needs to be used; others indicate the risks are too great and other methods should be used.

Others point out that insects and diseases have altered the ecological conditions, such as the elimination of the American chestnut by the non-native chestnut blight fungus and the wide-scale repeated defoliation by the gypsy moth. These changes affect other areas of concerns, such as wildlife habitats, recreation opportunities, and wood product values.

Where appropriate, the LMP would include an identification of the ecological conditions necessary to lessen the threats from forest pests. The management direction in the LMP should also be defined in such a manner that managers can determine the appropriate response when forest pests threaten an area.

In addressing this issue, management activities would strive to accomplish:

- Forest ecosystems are managed, either through restoration or maintenance, to provide the desired composition (species mix), structure (age class distribution), function (resulting benefits), and productivity over time.
- Management activities will reduce the impacts from non-native invasive species.

Table 2-12 shows the comparison of Issue 9 by alternative.

Table 2-12. Issue 9 – Forest Health

Issue/Units of Comparison	A	B	D	E	F	G	I
Forest Health Concerns	Ranking						
Southern Pine Beetle	M	L	M	M	L	H	M
Littleleaf Disease	L	H	L	H	L	H	M
Oak Decline	M	M	L	M	L	H	M
Gypsy Moth	M	M	L	M	L	H	M
Prescribed Fire	Acres in Thousands						
Estimated Acres Prescribed Burned (Total)	19.6	33.0	20.1	33.2	19.4	10.4	23.6
Restoration							
Acres with a Restoration Emphasis (Rx's9A3, 9E, 9G2, 9H)	0	220,512	0	0	0	94,469	54,440
Estimated Annual Acres of Invasive Plant Control	50	500	1,250	500	250	250	750

Issue 10 - Special Areas and Rare Communities

The current LMP identified several types of "special areas," which are areas the Forest Service has the authority to administratively designate. Areas can be designated for special or unique aesthetic, archeologic, biologic, geologic, historic, paleontologic, scientific resource values; or areas can be designated that provide unique and exceptional recreation experiences. Ecological communities such as caves, coves, rock outcrops, balds, and wetlands have been identified as possible "special areas." Concerns have been raised that some of these special areas are not adequately protected from activities in the surrounding areas, indicating the possible need for larger areas to be protected. In some cases, additional LMP direction would be needed to preserve and protect natural sites, as well as historic and prehistoric roads/trails.

Numerous concerns have been expressed about managing rare communities, such as those identified in the SAA. The assessment states that conservation of 31 rare terrestrial communities is key to conserving rare plant and animal species. Eighty-four percent of federally listed terrestrial threatened and endangered species in the Southern Appalachians is associated with rare communities and streamside habitats, which occur on less than one percent of the area. Similar groupings of listed aquatic and semi-aquatic species can be identified, although typing and inventory of rare aquatic communities has not been completed.

Comments have been made that rare communities are limited by past land uses and current management. Some express concern that timber harvesting and recreational uses would further reduce these communities if they are not protected. Other comments indicate that the biggest threats to these communities are from insects and diseases. Still others express that existing land allocations adequately protect most of these areas and there is no justification for establishing additional areas for special protection. The revised LMP would consider a range of management options for these areas and determine which options are needed to protect, maintain, or enhance these rare communities.

In addressing this issue, management activities would strive to accomplish:

- Protection or restoration of the rare communities found on national forest lands.
- Manage areas with special geological, paleontological, botanical, zoological, cultural, or heritage characteristics (or where feasible, restored) to protect those characteristics.

Table 2-13 compares Issue 10 by alternative. This table shows acres allocated to special areas (includes botanical areas and scenic areas) and the management of rare communities across alternatives on the Sumter National Forest

TABLE 2-13. ISSUE 10 – SPECIAL AREAS AND RARE COMMUNITIES

Issue/Units of Comparison	A	B	D	E	F	G	I
Special Areas	Acres						
Acres Allocated to Special Areas (Mgmt. Rx 4D and 4F)	5,215	5,499	7,895	6,751	10,199	10,664	14,419
Rare Communities							
Rare Communities Managed According to the Rare Community Mgmt. Rx (9F)	Yes	Yes	Yes	Yes	No	Yes	Yes
	Acres						
Estimated Acres of Annual Restoration Activities for Table Mountain Pine	50	250	50	150	0	150	250
Estimated Acres of Annual Restoration Activities for Canebrakes	50	300	50	100	0	400	200
Estimated Acres of Annual Restoration Activities for Glades and Barrens	50	250	50	150	0	150	250

Issue 11 - Wild and Scenic Rivers

The designation of wild and scenic rivers is a multistage process. “Eligibility” is determined through an inventory of streams and rivers that have outstandingly remarkable values (ORVs). Eligible streams then are classified as wild, scenic, or recreational. Next, “suitability” studies of the streams and rivers are accomplished to determine which streams and rivers can be recommended to Congress for possible designation.

There may be some circumstances where not all the eligible rivers would be studied for suitability during the LMP revision process. For those eligible rivers that would not be studied for their suitability, the LMP revisions will need to establish management measures to protect or enhance their ORVs until the next stage is completed.

When eligible rivers are analyzed for their suitability in the revised LMP, the determination of whether or not to recommend an eligible river for designation would vary, based on the overall management emphasis of the LMP alternatives. Some people have responded that they want certain rivers or all eligible rivers recommended for national designation. For those rivers recommended for designation as WS&R, methods of protecting or enhancing the rivers’ ORVs will vary according to their classification.

Rivers that do not become recommended for national designation would still be managed to protect their outstanding values. These rivers that are eligible, but determined to be not suitable, would be managed in a variety of ways ranging from preservation, to restoration, to simply following the state Best Management Practices and the Clean Water Act.

In addressing this issue, management activities would strive to accomplish:

- Wild, scenic, and recreational rivers that are designated by Congress, recommended for designation, or are eligible for designation, will be managed to protect their outstandingly remarkable values.

Table 2-14 shows the comparison of Issue 11 by alternative.

TABLE 2-14. ISSUE 11 – WILD AND SCENIC RIVERS

Alternatives/Units of Comparison	A	B	D	E	F	G	I
Wild and Scenic Rivers	**Miles**						
Miles of Rivers Currently Designated	57.0	57.0	57.0	57.0	57.0	57.0	57.0
Miles of Rivers Eligible	62.1	62.1	62.1	62.1	62.1	62.1	62.1
Prescriptions Allocated to Eligible River Corridors	1B, 2B1, 2B2, 2B3, 4D, 5C,10B,12A	1B, 2B1, 2B2, 2B3, 4D, 5C	1B, 2B2, 2B3, 4D, 5C, 10B	1B, 2B1, 2B2, 2B3, 4D, 5C, 12A	1B, 4D, 4F, 5C, 7E1, 8A1, 10B, 11, 12A	1B, 2B1, 4F, 6B, 6D,	1B, 4D, 4F, 5C, 7A, 7E2, 8A1, 9G2, 10B

Issue 12 - Access and Road Management

System roads are the primary means of national forest access; however, they are also a source of many concerns. These concerns predominantly center on the environmental effects of roads (which will be addressed in other issues, such as riparian, threatened, and endangered species, etc.).

Some people would like to see the motorized access to the national forests increased, especially during hunting seasons for big game, for other recreational uses, or to meet forest management needs. Other people, however, are concerned that road construction would be limited and some existing roads obliterated. Other comments were made that new roads should not be constructed for the purposes of logging or for OHV use. The amount of motorized access would need to be balanced with wildlife habitat needs, the need to provide both motorized and non-motorized recreational opportunities, the need to protect the soil and water resources, and the need to have management access.

The revised LMP would need to identify what, if any, are the appropriate road density standards and seasonal restrictions needed to meet the desired conditions established in the LMP.

The following table displays differences in access and road management across alternatives on the Sumter National Forest.

In addressing this issue, management activities would strive to accomplish:

- Provide a transportation system that supplies and improves access for all forest road users within the capabilities of the land.
- Provide a minimum transportation system that supplies safe and efficient access for forest users while protecting forest resources.
- Provide better quality access by upgrading highly used forest roads; and any roads that are needed but are adversely affecting surrounding resource values and conditions.

Table 2-15 shows the comparison of Issue 12 by alternative.

TABLE 2-15. ISSUE 12 – ACCESS AND ROAD MANAGEMENT

Alternative/Units of Comparison	A	B	D	E	F	G	I
Transportation System	Acres in Thousands						
Construction and Reconstruction Prohibited	15.1	14.9	9.6	13.8	8.4	13.6	8.1
Density of Open Roads and Motorized Trails Should Decrease Over Time	18.2	143.0	6.5	251.0	28.1	225.3	73.3
Density of Open Roads and Motorized Trails Should Remain Near Existing Levels	324.3	203.2	345.0	92.8	323.8	122.2	279.7
Density of Open Roads and Motorized Trails May Increase Over Time	3.5	0	0	3.5	7.2	0	0

Issue 13 – Chattooga River Watershed

Issues relate to managing the Chattooga Watershed for the desired social and ecological benefits while protecting the outstanding values of the Chattooga Wild and Scenic River corridor and whether or not the Chattooga Wild and Scenic River corridor should be open to boating above Highway 28.

The Chattahoochee-Oconee National Forests in Georgia, Nantahala National Forest in North Carolina and the Sumter National Forest in South Carolina share management of about 70 percent of the lands within the watershed. The Chattooga Wild and Scenic River corridor also lies within portions of the three National Forests, with the Sumter being the lead forest for management programs and direction pertaining to the Wild and Scenic River boating and instream recreational uses. Each forest manages the other land based activities within the Corridor. Direction for the wild and scenic river corridor is in Management Prescription 2A for each of the forests, and in Management Area 2 for the Sumter portion of the watershed.

The Chattooga River watershed drains water from an area that intercepts three states and their three national forests. The watershed headwaters in North Carolina begins at high elevations (4,900 feet) where the annual rainfall averages 80-inches-plus and supports a diverse mountain forest characteristic of the Southern Appalachian Mountains. Near its confluence with the Tallulah River, the watershed flows out of the mountains into lower elevations (900 feet) with characteristic Upper Piedmont landscapes.

The watershed covers a total of 180,795 acres in the three states of Georgia, North Carolina, and South Carolina, with national forests comprising 122,192 acres. Within the watershed are rugged mountains, narrow valleys, and rolling hills, each with distinct resources and land uses. A primary value of the watershed is the relatively remote setting, with dense mature pine and hardwood forest within the Chattooga Wild and Scenic River and the surrounding corridor. The river and watershed have been the focus of numerous ecological and recreational studies due to high public interest since its designation by Congress. Three projects in the 1990s emphasized the concerns and benefits of the watershed. The Chattooga River Watershed Ecosystem Management Demonstration Project (1993-1995) brought together scientists and land management agencies to develop a number of analysis tools and reports. Products included a multi-scale ecological classification, basin-wide evaluations of water quality, and a development of desired future conditions for the range of issues in the watershed.

The U.S. Environmental Protection Agency brought together a cooperative effort in 1996 to evaluate water quality conditions within the streams of the Chattooga. As part of a settlement agreement before a U.S. District Court, the EPA conducted an assessment of waters using the latest technology. Techniques and methodologies were used to develop protocols for water quality evaluations useful in any watershed. A result of the project was the listing of several stream segments on the 303(d) list of impaired waters in Georgia. A sediment yield model originated from the studies to be used in addressing total maximum daily loads (TMDLs) assigned by the State water quality agency.

A recent effort to address the restoration of watershed conditions has been the Chattooga River Large Scale Watershed Project, designated by the Chief of the Forest Service in 1999. The large scale watershed project, one of twelve in the United States, organized resources across the watershed to inventory stream conditions, upgrade road conditions, and enlist owners of private lands in addressing watershed conditions. Using data and protocols developed by the previous projects, stream inventories are in process to develop a common aquatic data set of conditions. Several primary roads and trails have been upgraded to address conditions contributing to stream sedimentation. A primary focus of the project has been the participation of owners of private lands in identifying problems and implementing solutions with multiple benefits.

Each of the twelve projects mentioned above has provided data, evaluation models, and insight from the public to address the issue of basin-wide management of the Chattooga River Watershed. Throughout the development of the revised Land Management Plan, the National Forests have worked cooperatively with the state and local governments,

and the citizens of the watershed to develop a range of alternatives to move toward desired future conditions for the watershed.

When Congress designated 57 miles of the Chattooga River corridor as a component of the National Wild and Scenic River System on May 10, 1974, they probably had no idea that the river would become a recreation focus and nearly 100,000 people would be floating the river each year. The river corridor and its immediate surroundings offer many recreational uses besides boating, such as fishing, swimming, floating, hiking, horseback riding, camping, and sightseeing in remote–and occasionally in roaded–settings. Recreational boating (kayaking, canoeing, and rafting) has been a popular use of the river and includes both guided and self-guided users. Water quality declines in some sections, especially below the confluence with Stekoa Creek (Georgia) or in relation to storm events in other areas.

The existing boatable portion of the Chattooga River is divided into four sections. Section I is the West Fork of the Chattooga River in Georgia ending at the main river channel. Section II begins at the Highway 28 bridge and ends at Earl's Ford. Section III begins at Earl's Ford and ends at the Highway 76 bridge. Section IV begins at the Highway 76 bridge and ends at Tugalo Lake. The uses of the river are regulated by section, season, water level, and type of use (commercial and private).

The proposed alternatives offer a range of management options for the lands and resources of the watershed. Management prescriptions allocated address old growth, wildlife habitat needs, backcountry, wilderness and roadless, restoration of vegetation associations, provision of high quality water for recreation and fisheries, and maintenance of the wild and scenic river.

In addressing this issue, management activities would strive to accomplish:

- Management of the Chattooga Watershed for desired social and ecological benefits while protecting the outstanding values of the Chattooga Wild and Scenic River corridor.

Table 2-16 shows the comparison of Issue 13 by alternative.

TABLE 2-16. ISSUE 13 – CHATTOOGA RIVER WATERSHED

Issue/Units of Comparison	A	B	D	E	F	G	I
	Dominant						
Management Prescriptions > 5,000 acres (Sumter and Chattahoochee-Oconee NFs)	2A 7E1 7E2 10B 12A	2A 8A2 9A3 9H	1B 2A 9H 10B	1B 2A 7E1 7E2	2A 10A 10B	1B 2A 4F 6C 6A	2A 4I 7E2 8A1 9A3 9H
	Miles						
Miles of Chattooga River opened to boating above Highway 28	10	0	0	20.7	0	0	0

Issue 14 – Minerals

Mineral exploration or development will be compatible with the desired condition of the appropriate management prescriptions or management areas. There are three categories of availability for mineral leasing purposes. The first category consists of lands not available for lease. These lands have either been withdrawn from mineral entry administratively, by law, or the Forest has determined that a prescription goal cannot be accomplished if the lands were open to mineral entry. The second category allows leasing, but there are no-surface-use or controlled-surface-occupancy stipulations attached to any lease issued on these lands. The third category consists of lands that are available for lease with standard lease stipulations.

In addressing this issue, management activities would strive to accomplish:

- Meet demands for energy and non-energy minerals consistent with forest plan management prescriptions.

Table 2-17 shows the comparison of Issue 14 by alternative.

TABLE 2-17. ISSUE 14 – MINERALS

Alternative/Units of Comparison	A	B	D	E	F	G	I
	Percent of Total Forest Acres						
Not Available for Lease	4.2	3.8	2.6	3.5	2.7	3.8	3.0
No Surface Occupancy or Controlled Surface Use Stipulations	24.4	32.5	23.4	36.6	4.4	45.7	33.6
Available for Lease with Standard Stipulations	71.4	63.7	74.0	59.9	92.9	50.5	63.4

Conformance with RPA

The National Forest Management Act (NFMA) regulations at 36 CFR 219.12(f)(6) require forest plans to respond to and incorporate the Renewable Resources Planning Act (RPA) program objectives. The last RPA program was developed in 1995. Currently the Forest Service Strategic Plan (2000 Revision) provides broad overarching national guidance for forest planning and national objectives for the agency as required by the Government Performance and Results Act. All of the alternatives in this EIS incorporate these broad strategic objectives.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The purpose of Chapter 3 is to present before-and-after views of the forest environment. It is to discuss the environment as it is currently and as it would be if the alternatives were implemented.

The "Affected Environment and Environmental Consequences" discussions are required by the National Environmental Policy Act (NEPA) that implements regulation under (40 CFR 1500). Each resource is first described by its current condition. These descriptions are limited to the background information necessary for understanding how forest plan alternatives may affect the resource. The resources listed and their sub-headings are designed to address issues raised throughout the planning process.

After each discussion of the current condition of a resource, the potential effects (environmental consequences) associated with implementation of each alternative are discussed. All significant or potentially significant effects—including direct, indirect, and cumulative effects—are disclosed. Where possible, the effects are quantified. Where this is not possible, a qualitative discussion is presented.

Programmatic verses Site-Specific

For estimating the effects of alternatives at the programmatic forest plan level, the assumption has been made that the kinds of resource management activities allowed under the prescriptions will in fact occur to the extent necessary to achieve the goals and objectives of each alternative. However, the actual locations, design, and extent of such activities are generally not known at this time. That will be a site-specific (project-by-project) decision. It is also unsure if the budgets needed to implement the specific activities will be forthcoming. Thus, the discussions here refer to the potential for the effect to occur, realizing that in many cases, these are only estimates. The effects analysis is useful in comparing and evaluating alternatives on a forestwide basis but is not to be applied to specific locations on the forest.

Types of Effects

Environmental consequences are the effects of implementing an alternative on the physical, social, and economic environment. *Direct environmental effects* are defined as those occurring at the same time and place as the initial action. *Indirect effects* are those that occur later than the action or are spatially removed from the activity in the foreseeable future. *Cumulative effects* result from the incremental effects of actions added to other past, present, and reasonably foreseeable actions, regardless of what agency (federal or non-federal) or person undertakes the other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

PHYSICAL ELEMENTS

Soils

Affected Environment

A soil is the part of the Earth's surface composed of organic matter, minerals, and living organisms and is capable of supporting a wide variety of biological, chemical and physical processes, and the cycling of nutrients and water. Soil is the result of weathering of parent rock material over extended periods of time influenced by climate and living matter, conditioned by relief, and effected by both natural events and the cultural alterations or uses of human beings. Soil physical materials consist of sand, silt, clay, and organic matter. Other particle sizes such as gravel, cobbles, and boulders may be included with the soil mixture as a result of past geologic, geomorphic, and hydrologic movements. These materials can be found in various combinations, depths of internal soil features, and development type from residual materials, erosion, or deposition, to form a soil series. Geology, climate, moisture, wind, and hydrologic regimes can have an influence on soils.

The soils on the Sumter National Forest vary between the piedmont and mountain topographic regions. The piedmont soils are formed from crystalline rocks, mixed acid rocks, micaceous rocks, and Carolina slates. The mountain soils are formed from colluvial materials weathered from gneiss, schist rock, and granite materials.
The piedmont soils on the Long Cane and Enoree Ranger Districts consist of 63 soil mapping units, with many of these due to divisions which show past moderate or severe erosion areas. Andrew Pickens District soils consist of 22 soil mapping units. Mapping units have at least 50% of a primary soil series, with the remaining areas consisting of other similar or non-similar areas. The smallest mapping unit is typically 8 acres, so local inclusions of other soil types within a mapping unit may be found.

Soils of the piedmont are located on gently to steeply rolling hills with generally well-drained sandy to mixed alluvial valleys. Due to past cultivation practices, most of the moderate to steep areas have been moderately to severely eroded leaving a thin- to no-

surface soil horizon. Even some relatively flat areas have also been affected from old agricultural terraces that have failed, activating the formation of gully channels from the concentrated flow. Soils high in mica content are sensitive to several forest ground disturbing activities due to high erodibility when exposed and the potential for the soil to compact. The B horizon in the piedmont has some resistance to erosion due to the elevated clay levels. However, gullied lands have typically eroded past the soil B horizon, exposing the deeply weathered parent materials (saprolite) in the C horizon. The saprolite materials are incompetent, droughty, nutrient deficient and extremely erosive when exposed to rainfall and/or concentrated flow. Gullies and galled barrens are occasionally found in these severely eroded areas.

The major soil concern on the forest is soil productivity. Soil productivity varies widely due to past erosion severity and varying characteristics such as soil depth, available water holding capacity, nutrient status, and site characteristics including elevation, slope, and aspect. Poor soil productivity not only affects the growth of plants, but also affects water quantity and quality, and biological and other resource capabilities of the land. Gullies and galls that were formed have affected soil productivity by depleting nutrients, water absorption, and availability (Hoover, 1949). There are still erosional gullies, galls, and bare soil found on the Long Cane and Enoree Districts, and to a much lesser extent, on the Andrew Pickens District. The past erosion was so extensive that almost all of the piedmont surface soils have eroded leaving less than 2 inches of soil surface (A horizon) on most of the landscapes. Moderately eroded sites (approximately 192,000 acres) have 1-3 inches of soil surface. Severely eroded sites (over 22,300 acres) have less than 1 inch to no soil surface. These areas will require treatment to improve soil productivity. Soil and water improvements continue to reduce or obliterate the effects of the gullies and severe erosion on National Forest System lands in the piedmont. Without improvements, these and adjacent lands will continue to decline in productivity.

Soils of the mountains are generally well drained, but have a wide range of slope and landform conditions from nearly level to gently sloping areas in the floodplains, gently to steeply sloping areas on side-slopes, with mostly narrow and irregular ridgetops. Some of these soils contain high levels of mica, but not enough to be classified as micaceous. Soils high in mica are highly erosive and are located throughout the district, but tend to have the highest levels concentrated toward the North Carolina border. Site-specific soil surveys may be needed prior to implementing extensive soil disturbing activities. There are differences in the soil series relative to productivity, erodibility and soil stability. These soil differences are based on a variety of factors including geology, soil structure, horizon depths, slope, litter depth, vegetative cover, aspect, and subsurface drainage.

Soil Productivity

Various legislative and executive mandates and Forest Service policies address land productivity. The National Forest Management Act (NFMA) of 1976, Section 6 (3)(E)(i), restricts timber harvest from National Forest System lands to only where "soil, slope, or other watershed conditions, will not be irreversibly damaged". Likewise, Forest Service Regulations (36 CFR 219.14 (a)(2)) limit timber production to lands where soil

productivity and watershed conditions won't be irreversibly damaged. Timber must be harvested “in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and esthetic resources, and the regeneration of the timber resource.” As a safeguard within the act, Section 6 (3)(F)(2), and Forest Service Regulations (CFR 219.27 (a)(1), (b)(5)), require an evaluation of the effects of management and the elimination of activities that may substantially and or permanently impair productivity of the land.

Soil productivity is one of the primary concerns on the forest, and is evaluated using Regional Soil Tolerance Guidance (1982). Existing or potential conditions in the piedmont that influence soil productivity include soil type, aspect, erosion potential, nutrient status, and past land use. Soils in declining or unsatisfactory watershed conditions are especially sensitive to land use changes, wildfire, and intense storm events. Rejuvenation of severely eroding lands in the piedmont has the potential to increase soil erosion, water pollution, and downstream sedimentation; reduce site productivity for timber and certain wildlife species; and reduce the local water table. Flooding severity may increase if soil conditions are not maintained, enhanced, or improved (Hoover, 1949). Downstream impacts may include sedimentation and loss in channel capacity. The inventory of eroding and low productivity lands will be updated and included in the Watershed Improvement Needs Inventory (WIN) database. Existing inventories show about 2,000 acres of eroding lands needing structural treatment. This is not a complete inventory of needs and does not include streambank and channel improvements that have not been inventoried. Nutrient deficient lands needing fertilizer treatment are estimated at 28,000 acres. Other areas needing improvements may also be located during project reconnaissance or acquired through land exchange or purchase. Soil or watershed conditions in poor and/or declining conditions will be assessed and treated. Besides stabilizing severe erosion, native plants are being used to help achieve long term erosion control, build soil organic matter, enhance responses to natural disturbances, improve poor soil conditions, increase resilience to disturbance (flooding, fire, drought, insects and disease) and provide low maintenance needs (Law et. al., 2000).

There are four productivity classes on the forest that describe the capability of an area. Productivity classes I and II are fertile, well drained soils located on broad ridgetops on most of the piedmont. They include a small percentage of class I and II lands in floodplains that are poorly drained to very poorly drained. Most of the soil in productivity classes III and IV are lacking a soil surface layer and produce less than desired surface cover and vegetative health. Most soils of the piedmont have low nutrient levels. In general, soils are well developed with deep profiles, shallow A horizons and organic surface layer and good hydrologic condition. The piedmont districts have approximately 12% productivity class I acreage, 54% class II acreage, 22% class III acreage, and 12% class IV acreage.

Productivity classes I and II in the mountains are fertile soils usually located on northern and eastern aspects with deep soil profiles (40-inches-plus) and a well developed organic and A horizon. Also, all of the floodplains and wetlands are found in productivity classes I and II. Productivity classes III and IV are low in fertility, usually located on southern

and western aspects with moderately deep soil profiles (less than 40 inches), and shallow developed A horizons with little or no organic accumulation on the surface. Rock outcrops are occasionally found on the soil surface. Colluvial soils are especially susceptible to land slippage and need care in location and design of activities such as road building. The mountains have approximately 25% productivity class I acreage, 28% class II acreage, 37% class III acreage, and 10% class IV acreage.

Fertilization or other treatments may be required on productivity III and IV lands to maintain and improve watershed condition. Fertilization increases the health of the trees, understory vegetation, and root structure that tie up nutrients and eventually contribute to organic and nutrient cycling increases in the litter and surface soils (McKee and Law, 1985, McKee et. al., 1995). Approximately 28,000 acres of eroded, low site lands in the piedmont of South Carolina need to be fertilized. Fertilization improves both the understory cover and variety and health of existing trees. Without fertilization, understory vegetation is marginal and pine mortality is higher due to their lack of vigor and increased susceptibility to insects and disease. Fertilization on these lower site pine lands enables the pine trees to grow until stand regeneration age or in some instances, even older ages, which helps meet mature timber habitat goals. On low site lands, thinning and harvest activities try to retain an even distribution of limbs and other organic debris in place when harvested. When prescribed burning is considered, only low intensity fires are desired in order to retain duff and humus layers, except where dense stands of native grasses or other resilient cover have developed or been planted. Without fertilization, many of these areas cannot meet their physical and biological potential.

Some concern exists that the non-native plants will outperform native species when fertilization occurs. Persistent and invasive non-native plants are being avoided. Containerized growing of many native grass, shrub, and tree species from the Sumter National Forest have shown that they also respond exceptionally well to fertilization (Law et. al., 2000). Where cover crops of non-native species are needed, annuals or species that do not persist are selected so they do not out compete the native species. Since many of the non-native species do not respond well to prescribed fire, while the native species flourish, fire is a likely tool that might be increased when understories remain dominated by non-native species. The goals of fertilization are to provide a needed shot of the nutrients that are extremely deficient in the soil in order to improve the short-term absorption and assimilation of nutrients into the soil cover, increasing soil organics and plant health.

Various programs assist in protecting, improving, and maintaining soils so they can accommodate a variety of resources. Soil and water improvements help to address existing problems that are not a direct result of past or ongoing forest programs. South Carolina Best Management Practices (1994) include some soil conservation measures that help protect soil productivity from excessive erosion and disturbance. Timber harvesting includes provision for protection and improvements to soils and water resources through the Knutson-Vandenberg Act as amended in the National Forest Management Act of 1976. With these and other programs, soil and water conservation improvements are evident. Utilization of erosion control practices such as seeding,

mulching, fertilizing, liming, and maintaining forest and grass cover improve site productivity, especially on exposed, compacted soils of the forest. As a result of these programs, areas of bare soil, gullies, galls, eroding stream banks, non-system roads and trails, and other areas needing improvements show an increase in vegetative cover and stability. As vegetative cover increases, litter and duff layer continue to accumulate, decompose, and help establish an organic layer. Improving the organic materials to a functional level is key to nutrient storage and availability for plant growth and watershed protection. Organics improve water absorption, infiltration, storage, and availability that add to soil productivity and to resistance to soil erosion.

Activities Affecting Soils

The resource management areas that have an effect on the soil resource are Vegetation, Wildlife, Recreation, Fire, Roads, Minerals, and Special Uses. Elements within these resource management areas may affect soil productivity through a variety of processes including soil compaction, displacement, rutting, stability, erosion, and topsoil removal. These processes may alter aspects of how the physical, chemical, and biological properties of soil function. These alterations can influence nutrient, water, chemical, and air cycling within the soil. The application of forest standards and guidelines and the use of South Carolina Best Management Practices will minimize impacts on soil productivity and reduce soil erosion when implemented properly and in a timely manner.

Ground disturbing activities may influence soil productivity by compaction, soil displacement, slope stability, rutting, erosion, and topsoil removal. Most activities utilize preventative measures such as best management practices (BMPs) to limit or mitigate these effects through the management of where, when, and how activities are placed on the landscape. Some soil and water improvements are undertaken that may temporarily cause effects by exposing and recontouring problem soils, with the long-term intent to increase stability and function. In general, unless strict erosion control plans are in place, activities on treated areas should disturb or expose no more than 15% of an area. Areas that are reshaped or recontoured are aggressively treated to minimize erosion and sedimentation. A variety of measures are used to accomplish stabilization and restoration of problem gully, road, galled, and other sites (Hansen, 1991, 1995; Hansen and Law, 1993, 1996; Law et.al., 2000).

Type of Soils

Compaction is the reduction of soil volume due to an external force such as from the use of heavy equipment on moist soils, which results in alteration of soil chemical and physical properties. Soil compaction alters soil structure by decreasing macro pore space and soil porosity. This reduces productivity by retarding root growth as well as air and water/nutrient transfer in the soil. Surface soil recovery from compaction is relatively rapid on sandy soils, but may take decades to recover on soils with clay near the surface unless some form of mitigation is used. Periodic freezing, thawing and fertilization can increase the rate of recovery. Any activity requiring the use of heavy equipment can

cause some degree of compaction, but excessive compaction is often related to certain soil types and moisture levels.

Soil displacement moves soil surface material from its original position on the landscape. The displacement typically is small, perhaps a few inches to a few yards and often has a vertical and horizontal component from the original location. It can alter the rich organic and mineral surface soil layer from one place to another through mechanical means (e.g., skidding of logs, blade construction of skid roads, landings, temporary and system roads, ATVs, etc.). It can also accelerate erosion and reduce nutrient supplies, which are all important to plant growth. On saturated soils, soils may reach their plastic limit and displace under the weight of heavy equipment. Excessive activity on saturated soils can also cause soil puddling, which is the breakdown of the soil structure bonds, resulting in soil particle displacement and mixture with water. Puddled soils make a poor growing medium because the pore structure is broken, air permeability is limited, and the soils retain water for extended periods. When dry, puddled soils have lost their soil structure and often develop deep cracks in the soil surface, making a very poor site for plant establishment and growth. Most plants have a difficult time rooting and growing under those conditions.

Slope stability is the capability of a soil to maintain its original position on the slope. Unstable soils in the mountains are typically colluvial soils. These soils are limited in extent, but may contain elevated groundwater or subsurface concentrated flow during wet periods that make them subject to slippage and slumpage when vegetation is removed or slope altering activities such as road construction and skidding are undertaken. This can potentially initiate or accelerate soil mass movement by undercutting, overloading a slope with subsurface water, or disrupting established subsurface drainage patterns. Areas with soil slope stability problems can affect roads, ability to harvest, and other activities.

Rutting is the destruction of the soil structure caused by heavy equipment loading and indentation into the soil surface. During dry conditions, rutting is less frequent and occurs mostly in isolated moist areas, or on primary skid trails where repeated skidder traffic gradually compacts the soil into an indenture in the landscape. When certain soils are moist and/or wet, rutting can be a significant problem, especially if natural regeneration methods are planned. It also changes the native plant communities on the area. Rutting is a highly visible impact of logging and can disrupt the normal hydrological flow of surface and subsurface water. Careful planning of activities will eliminate or minimize this effect. When activities cannot avoid sensitive soils, designed activity routes should be located prior to starting work to limit the extent of the effect.

Erosion is a natural process that dislodges soil particles and moves them. Soil exposure can be a result of natural and human-induced conditions. Exposed surface soil particles move during events with external forces such as rainfall, stormflow, and wind events. Forested soil is an excellent filtering mechanism that may absorb contaminants, preventing their entry into streams. However, when eroded, soil particles may include contaminants and may add to stream pollution upon delivery. Erosion that reaches the stream network is moved as a portion of the total dissolved solids or precipitates out

temporarily-to-semi-permanently as sediment. Careful design and use of BMPs can reduce both erosion and sedimentation.

Productivity is the composite of the compaction, displacement, rutting, slope stability, and erosion effects on soils. Most of these effects go unnoticed, unless a threshold is reached. Region 8 has guidance to address erosion loss and set standard estimating approach (USFS, 1992). In addition, the loss of nutrients or organic materials can change productivity. Productivity loss can typically be reclaimed with treatment, but at a cost and with sometimes years or decades of recovery.

Direct/Indirect Effects

Roads and Trails

A road is a motor vehicle travelway over 50 inches wide, unless designated and managed as a trail (36 CFR 212.1). A road may be classified, unclassified or temporary.

Classified roads are wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other road authorized by the Forest Service. Characteristics of classified roads vary with the amount and frequency of traffic, but they are specifically designed and located to meet long-term needs, with culverts sized to limit flood risk, road surfacing for traffic, adequate drainage and erosion control to limit sediment, and are maintained regularly with the frequency depending on their design, uses and conditions.

Unclassified roads found on National Forest System lands are not part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization. In most instances, the extent of unclassified roads are not completely known at this time, but they will be identified and evaluated in the Roads Analysis process during implementation of project activities to determine if they should be added to the system as classified roads or decommissioned.

Temporary roads are authorized by contract, lease, other written authorization, or emergency operation; not intended to be part of the forest transportation system; and not necessary for long-term resource management. Characteristics of temporary roads include low standard, minimum width, generally single use facilities to access an area and are sufficiently blocked to not allow any continued use by vehicular traffic or provide permanent road access. The road will be stabilized to prevent erosion, sedimentation and restored to near original condition after use by seeding or tree planting typically resulting in fully vegetated surfaces with no erosion or sediment within three years. These roads may not be designed to classified standards, and culverts, surfacing and other structures may be inadequate for extended uses. Since these roads are not maintained, removing

unstable or problem cuts, fills and culverts are necessary in streams, channels, wetlands, steep slopes and other sensitive areas.

Roads and trails expose and compact soils, alter surface and subsurface water flow patterns, and can alter stream channels during and following construction. Roads and trails directly and indirectly affect water by increasing sedimentation and concentrating runoff. Direct effects to soil and hydrology are excavating and compacting soils, filling, placing culverts, and using equipment in streams, riparian, and other sensitive areas. Stream alterations include channel confinement such as into a culvert with a localized loss of flood-prone areas, and inputs from road surface drainage that include added storm-water, sediment, and road traffic pollutants. Open roads contribute higher erosion and sedimentation rates due to ongoing maintenance activities such as surface scraping and shaping, ditch pulling or scraping, and normal wear and tear on the road surface from use. Road surfaces may also contain low levels of vehicle petroleum product pollutants that can be flushed into the aquatic systems during storm events.

Activities associated with closing roads and trails stabilize the road surface when properly drained and vegetated. Some flatter road and utility corridors are lightly disked to break the surface, then reseeded and mulched to provide linear wildlife strips. Some road closures may inadvertently leave in culverts or other road structures. These can become problems unless they were sized for permanent use and maintained. Roads and trails often create problems when located in riparian areas because they are difficult to drain, cause excessive compaction or displacement of soils, alter normal surface and subsurface flows, and increase pollution to streams.

Road and Trail Effects

Average erosion coefficients for construction of classified and temporary roads in this analysis were 54.9 tons/acre in the mountains and 2.66 tons/acre in the piedmont. Classified roads addressed in this analysis are the Forest Service system roads used for recurring and ongoing access needs. They are maintained and may be open, closed and reopened as needed, or seasonally open. Temporary roads are used to meet short term, non-recurrent needs. Reconstruction and maintenance activities for permanent roads were 23.4 tons/acre mountains and 1.13 tons/acre piedmont. The number of acres per road mile ranges from 2 acres/mile of temporary road with effects lasting normally about 3 years to over 5 acres/mile of permanent system road with ongoing effects. Existing foot and mountain bike trails averaged 1.42 tons/mile/year with 2.84 tons/mile for new trail construction. Horse trail construction averaged 14.1 tons/acre/year/mile with existing horse trails producing 7.04 tons/acre based on current trails in the piedmont and mountains averaging about 1 acre per mile of trail. The erosion coefficients for OHV/ATV trail construction (all occurs in the piedmont) were 5.68 tons/acre and existing 2.84 tons/acre, with about 1 acre per mile of trail. Road and trail coefficients were provided by Clingenpeel and Krieger (2002) from examples by physiographic area measured for SA forest plan revision. These estimates do not include off trail or unclassified road uses that are unauthorized and can be substantial in some instances.

Measures to rehabilitate unclassified roads and trails are implemented to block usage and reduce associated erosion and sediment.

Road and Trail Management Effects by Alternative

Estimated erosion effects by alternative for system road construction, reconstruction, maintenance, and closure activities indicate Alternatives G and E have the least erosion with 4,800 tons/year (t/y), with Alternatives A, B, D, F and I at 4,900 t/y, over the first decade. Addressed with other units and spread over the national forest, the 4,800-to-4,900 tons/year variation of erosion effects from trails is 8-9 tons/square mile/year, which is 0.01 tons/acre/year.

Trails produce less impacts with Alternatives B, D, F and G at 820 tons/year, Alternative I at 1,900 tons/year, and Alternatives A and E at 2,300 tons/year. Addressed with other units and spread over the national forest, the erosion effects from trails is 1-4 tons/square mile/year, which is less than 0.01 tons/acre/year.

Temporary roads were primarily associated with vegetation management activities, and their effects range from 6,900 tons/year for alternative G to 14,800 tons/year in alternative E, with Alternative I at 13,100 tons/year. Erosion from temporary roads ranged from 12-26 tons/square mile/year or 0.02 to 0.04 tons/acre/year.

The sediment effects of roads and trails to water resources were included with other activities estimated at watershed scales in the water quality effects section using the regional sediment model (Clingenpeel, 2002) and applying localized erosion coefficients (Hansen and Law, 2002).

Vegetation Management

Vegetation management activities that affect soil and water are timber harvesting, temporary roads, site preparation, timber stand improvement projects, skid trail construction, and felling, yarding, skidding, loading, and transporting logs. Most of these effects are temporary, lasting only a few years. Loss of the protective soil cover (litter) from ground disturbance can temporarily increase erosion and sedimentation while decreasing soil productivity. Chopping is typically used for site preparation on many of the slopes under 25% in the piedmont, and this activity can cause some temporary soil disturbance, exposure, and erosion. Various aspects of vegetation management can influence soil, water, and riparian conditions as summarized in various sections of the R8 Vegetation Management Plans (USFS, 1989). Activities under this section include many actions that are needed to maintain, manage, or manipulate vegetation densities and types to improve forest health and wildlife habitats.

Studies indicate that nutrient losses from timber harvests can be comparable to nutrient inputs, resulting in no long-term reduction of the ecosystem’s productive potential (Kimmins, 1977; Wells and Jorgensen, 1978; Patric, 1980; Grier et. al., 1989). Nutrient

losses from timber harvest were found to be small to negligible, with losses such a small fraction of total nutrient capital that site productivity should not be reduced (Sopper, 1975). Only where timber harvest is coupled with piling or windrowing of slash and all other woody and organic material on the forest floor by mechanical means, can demands on the soil potentially exceed the natural nutrient supplying capacity of the system. Intensive site preparation practices would exceed the regional soil tolerances for erosion and are no longer used for timber production activities on the national forest nor on most of the private and industrial lands. On private lands, site preparation with herbicides is now the standard method.

Water yields change somewhat when vegetative removal or conversion to pasture or grassland occurs because of reduced transpiration and raindrop interception (Hibbart, 1965; Hewlett and Hibbart, 1965). Typically, pine forests use more water than hardwood forests or grasslands. Activities that regenerate forests will typically cause some water increases for up to a decade, with increases in flow primarily during the base or low-flow periods. Roads, trails, and similar activities related to these uses are more likely to decrease low-flow and increase the quick or storm-flow values. These effects are most noticeable on localized scales and not normally at the watershed or landscape scales with normal forestry management that disperses activities over time and space. When water yield effects occur, they commonly last 5-to-10 years unless the forest is converted to another species type or land use. Some reduction in flows may be noticed during periods of rapid growth in young stands between 10 and 20 years of age (Swank et. al., 2000).

Vegetation Management Effects

Timber harvest can release nutrients bound in the soil and biomass by increasing organic material to the forest floor, increasing sunlight to the forest floor, increasing soil temperatures and resulting decomposition rates. Most areas regenerated in the piedmont with slopes under 25% will be drum chopped. Erosion from this activity depends on slope and ranges from 0.1, 1.1, and 2.5 tons/acre on slopes of 2, 15, and 25%, respectively. Areas converted to savanna or woodland will be burned on fairly frequent cycles to mimic the natural processes to restore native plants and grasses into the understory at high densities. Native grasses help to provide quality erosion control and resilience to fire, drought, and nutrient deficiencies. As organic matter levels rise, soil micro-organisms play an instrumental role in the conversion to humus, a relatively stable form of carbon sequestered in soils for long periods (decades and even centuries). Soils in the proposed treatment areas in all alternatives are capable of retaining released nutrients rather than losing them through drainage or volatilization. Timber harvest practices occur at infrequent intervals and will generally maintain soil productivity with close attention to BMPs. Clear and seed tree cuts lose only 5.8 tons/acre in soil loss on moderate slopes, to 8.9 tons/acre on steep slopes in the mountains, and 3.2-to-4.9 tons/acre in the piedmont (localized data from Dissmeyer and Stump, 1978; Goddard, 1982). One-third to one-half of these values is the estimated erosion from the skid roads and trails. Thinning, group selection and shelterwood cuts produce about 30-to-60% of the soil loss rates of the even aged regeneration cuts.

Because of southern pine beetle (SPB) infestation, continued pine cutting with leaving or removing trees helps to reduce the spread rate from that spot. Removing trees in salvage timber offers better opportunities to regenerate these areas, reducing the excess fuel buildup and fire hazard. Where salvage is viable, some of the sale funds help maintain or close roads and provide for soil, water, and other resource improvements when sufficient funds are available.

In contrast to the potential effects of logging on productivity and nutrient cycling, timber fallen, windblown, or killed by pests and diseases, if left-in-place would over the long term improve local soil productivity. As timber decays, it enhances many biological processes and physical attributes important for soil development and management.

Vegetation Management Effects by Alternative

Estimated erosion effects by alternative for probable vegetation management activities including temporary roads and skid trails indicate Alternative G has the least erosion with 20,500 tons/year; with Alternative B producing 37,100 tons/year; E, 35,600 tons/year; I, 35,300 tons/year; D, 35,300 tons/year; A, 37,400 tons/year; and F, 41,700 tons/year over the first decade. Addressed with other units and spread over the national forest, these values range from 35-to-73 tons/square mile/year, which is equivalent to 0.06-to-0.11 tons/acre/year. The sediment effects of vegetation management to water resources were included with other activities estimated at watershed scales in the water quality effects section using the regional sediment model (Clingenpeel, 2002) and applying localized erosion coefficients (Hansen and Law, 2002).

Fire Management

Historically, wild land fire is a natural component to the landscape, and can occur under a variety of conditions. Under some conditions, wild land fire is beneficial by removing fuel buildup and promoting a mosaic of wildlife habitat, rejuvenating some areas for rapid regrowth. Wild land fire can also produce undesired effects to adjacent landowners and the environment, e.g., suppression activities can have direct and indirect soil and water effects primarily from the location and construction of fire lines and firebreaks. Fire lines have many of the effects of skid roads, and mitigation measures to limit their effects are similar. Fire lines expose mineral soil, and when designed with drainage features such as rolling dips, flow is removed and dispersed into the forest and effects from erosion and sedimentation are limited. There is often little or no time to plan the best route for constructing fire lines, so mitigation following suppression activities is also important.

Under extreme circumstances that produce a severe burn, all or almost all of the litter, duff, and humus on the forest floor would be consumed, vegetation killed, and mineral soils exposed. Burns of this intensity are unusual occurrences and seldom found across large areas. In localized instances, the mineral soil may degrade by particle fusion or

develop a non-wettable soil layer that can restrict water infiltration until it breaks down. Severe burning can affect soil biota, structure, organic matter, and fertility, potentially triggering accelerated erosion and cycling of soil nutrients. Suspended solids, sediments, ash, and nutrients in streamflow might temporarily increase to unacceptable levels in nearby streams during storm runoff events.

Prescribed burning is designed to burn with less intensity with less direct and indirect effects to soil and water by removing much of the vegetative cover and litter, while protecting the duff and humus layers of the soil. Under most prescribed burning plans, only a small portion of the soil may be exposed, which may cause concentrated surface flow, erosion, and sedimentation. Prescribed burning goals include measures to maintain soil productivity and erosion control by protecting the duff and humus layers on the soil surface. Further measures as needed to provide erosion control include fertilization, seeding, and mulching. Low intensity burns typically do not reduce soil productivity or substantially increase stream sedimentation (R8 Vegetation Management Plans for Mountains and Piedmont, 1989). However, effects can increase substantially as the burn intensity increases, but these depend also on the soils, slope, topography, rainfall, and cover factors. Fire lines often produce more effects than the fire. Properly designed fire lines effectively limit effects to soil and water resources. These can be designed for reuse in areas of frequent burning cycles. Location, water, and erosion control are key components in limiting short and long term effects to soils and water resources. Rescraping the surface lightly when the area is to be reburned will reduce effects when compared to relocating and reconstructing new firelines. Quality fire lines also allow access during burning and erosion control activities for cost, safety, and environmentally effective treatments. With prescribed fire activities, fire lines can be placed more carefully on the landscape prior to or during construction activities than those constructed for wild land fire suppression.

Prescribed Fire Effects

The effects of prescribed fire on soil productivity can vary with soil conditions (e.g., antecedent soil moisture), soil properties and qualities, as well as the type, extent, intensity, and duration of the burn based on fuel loads and conditions. Published scientific studies have concluded that prescribed burns, implemented under managed or controlled conditions, have negligible effects on the physical, chemical, and biological properties of soils and soil productivity (Ralston and Hatchell, 1971; Johnson and Cole, 1977; Kodama and Van Lear, 1980; Richter, Ralston, and Harms, 1982; Douglas and Van Lear, 1982; Van Lear and Johnson, 1983; Van Lear, 1985; Van Lear et. al., 1985; Van Lear and Danielovich, 1988; Sanders and Van Lear, 1988; Van Lear, Thomas, and Waldrop, 1989; Van Lear and Kapeluch, 1989).

Prescribed burning is primarily low intensity, with perhaps minor portions at a moderate intensity. Areas that are burned hotter are usually in upland areas away from streams. Furthermore, there is little evidence that sedimentation increases significantly in streams from forested lands burned under conditions specified in an approved plan to meet wildlife, recreation, watershed, vegetation management, or ecological objectives. Under

these conditions, prescribed burning must retain most of the duff and humus layer on the soil surface. Prescribed burning is much less likely to increase erosion than mechanical methods of vegetation removal or intense wild land fires, which may result in stand damage or replacement. Intensities and durations of soil heating from prescribed burns are designed to be considerably less than those generated by wild land fire.

Prescribed burning has some low to moderate effects on nutrients and soil productivity, depending on slope and fire intensity. As native grasses and plants come to dominate the understory vegetation, organic content in the surface soils typically increases and soil productivity is improved at a faster rate than with forest management alone. Repeated burning at low intensities will generally maintain soil productivity, losing only 0.17 tons/acre on moderate slopes to 0.50 tons/acre on steep slopes in the mountains and 0.07-to-0.20 tons/acre in the piedmont (localized data from Dissmeyer and Stump, 1978; Goddard, 1982).

Historic Wild Land Fire Effects

Under historic wild land fire conditions, it was estimated that about 10% of all acres would be severely burned, with 40% moderate and 50% low intensity. When considering the estimated natural wildfire erosion effects at landscape scales, resulting in approximately 0.04 tons/acre/year in the piedmont and 0.11 tons/acre/year in the mountains, the overall effects of the prescribed burning activities are reduced (Barrett, Kerr, and Hansen, 2002).

Prescribed Fire Effects by Alternative

For prescribed fire, it is estimated that 2% are severely burned areas which have temporary soil exposure, with the remaining 13% has a moderate burn with infrequent areas of soil exposure and 85% low intensity burn with essentially no exposed soils. Over the first decade, it is estimated that temporary soil exposure from the minor areas that are severely burned would occur on about 200 acres per year in Alternative G; with about 400 acres/year for Alternatives A, D, F; nearly 500 acres/year for Alternative I; and close to 700 acres/year for Alternatives B and E. These areas of temporary soil exposure are typically in small patches and well distributed elements within the landscape. As mentioned, areas of more intense burn are usually in upland areas, away from streams.

Erosion is temporarily increased but relatively minor from prescribed fire when conducted at low intensity. Since almost all of the area is burned at low intensity, erosion estimates for the alternatives assumed low intensity prescribed fire. Rates from fire were based on 0.13 tons/acre with additions for fire lines based on 5 acres/1000 acres treated averaging 11.2 tons/acre. Estimated erosion from probable prescribed burning treatments including fire lines indicated that Alternative G has the least erosion from national forest management activities with 1,900 tons/year. Alternative D has 3,700 tons/year; A, 3,600 tons/year; I, 4,400 tons/year; F, 3,600 tons/year; B, 6,100 tons/year; and E, 6,200 tons/year over the first decade. Addressed with other units and spread over the national

forest, these values range from 3-to-11 tons/square-mile/year, which is equivalent to 0.005-to-0.02 tons/acre/year.

It is projected that the prescribed fire program could potentially have some localized temporary adverse impact on soils. These high and moderate intensity areas are normally well-distributed local patches throughout the burn area, but typically not in riparian areas. The sediment effects of prescribed burning to water resources were included with other activities estimated at watershed scales in the water quality effects section using the regional sediment model (Clingenpeel, 2002) and applying localized erosion coefficients (Hansen and Law, 2002).

Wildlife and Habitat Management

A variety of treatments is used to manipulate vegetation to meet specific wildlife and biotic viability, habitat, public hunting, or observation activities. Most of these areas include some form of road or trail access and are located on relatively flat lands under 8% slope, where erosion is relatively low. Constructing sites from forest areas may include activities such as clearcutting, stumping roots, piling debris, smoothing, disking, fertilizing, seeding with desires and/or native species, and mulching. Many of these sites were developed from lands that were farmed prior to being acquired in the 1930s. Most access to openings occurs on existing roads of past use. Some of these areas are probably prime farmlands, but none of the activities being utilized would change this status. New construction require access with current standard, but suitable existing access would be utilized as possible. Problem access roads or routes would be upgraded as needed to limit erosion and sediment effects. Maintenance activities regularly include mowing and infrequent burning when contained within prescribed fire treatments. Regular treatment with fertilizer or selection of nitrogen-fixing plants in the seed mixture help to maintain productivity. Increased use of native plants is encouraged and may result in less intense maintenance and maintenance of soil cover and roots. Other erosion reduction measures include using contour, no- or low-till, and leave-strip treatments.

Cultivating, disking, or breaking the soil surface is used on a portion of the wildlife opening areas at about 3-year intervals on dove fields, select wildlife food plots, and linear wildlife strips on relatively flat sections of closed roads and transmission lines. Fertilization, seeding, mulching, and other erosion control measures are necessary in order to maintain soil cover and nutrients and to limit erosion and sediment, especially on sites with slopes over 3% slope that are repeatedly treated.

Woodland and savanna conversion and management necessitate thinning areas to low basal areas in conjunction with conducting frequent burning cycles. The timber harvest effects were discussed under vegetation management. Short-term effects from frequent burning will include reduction in litter, duff, and humus layers, with eventual development of native grass and shrub understories. Once developed, native grasses are more resilient, require less maintenance, and can withstand more or are not as susceptible to disturbance (such as fire, drought, insect, disease, and poor sites) as most non-native species. Once developed, native grasses have dense root networks that help to increase

soil development, organic content, and productivity. Areas converted to woodland and savanna management may include some short-term increase in base-flow, erosion and sediment, and long-term site productivity. Areas burned with moderate intensity will affect soil productivity if on steep slopes. Areas burned with severe intensity will influence soil productivity on all but relatively flat slopes.

Cane restoration, water bird habitat development, thinning, and other probable activities are planned at various levels by alternative within selected riparian areas outside of the streamside management zone. Cane restoration activities within the piedmont will include timber thinning and prescribed burning within the riparian area. In some instances, timber will be girdled and left standing to create openings, but will avoid impacting the area by building access and removing trees. Under acceptable conditions that protect riparian resources, commercial sales may occur. The effects of these activities will be similar to uplands except that there will be more stringent equipment limitations to reduce soil compaction, displacement, and exposure. The effects are sometimes less intense in the flat riparian soils due to high organic content and low slopes. Due to the proximity to streams, impacts from rutting, erosion and sediment are still possible if attention is not given to implementing BMPs during dry soil conditions and maintaining low disturbance of the riparian filter zone.

Water bird habitat developments are typically located within the floodplain or riparian terrace of larger rivers and streams. Existing waterfowl habitat management areas occur on Duncan Creek, Tyger River, Enoree River, and Broad River. Dikes are installed to retain water on these areas and water control measures are often included. Other activity by beavers has also produced some areas that contribute to the extent of this habitat on the piedmont districts. On occasion, small dams and ponds in headwater or small stream circumstances have created some localized water bird, salamander, or other habitats. Among other issues, fish and aquatic organism migration is a concern with these developments. In some instances, cultivation of adjacent lands may be included to increase food plantings and public hunting opportunities, with effects to soil productivity, water quality, and aquatic habitats carefully weighed. Activities will be designed and maintained to meet the intent of Executive Orders 11988 on Floodplain Management and 11990 on Wetland Management. Structures in the floodplain will address the 100-year floodplain for hazards and design needs. Structures will avoid, minimize, or mitigate effects to jurisdictional wetlands, navigable waters, and other waters of the United States. Appropriate state and Federal permits will be obtained as required. Considerations relative to riparian and aquatic habitats, water quality, and other resources will have to be evaluated on a case-by-case basis.

Wildlife Management Effects

Some intensive treatment methods are employed on localized areas to provide early successional wildlife habitats by converting forests to openings. Practices may include clearcutting, shearing, stumping, root raking, piling, burning piles or debris, ripping, cultivating, disking, liming, fertilizing, seeding, and/or planting. Some of these areas are maintained by disking regularly, but most are prescribe burned or mowed a few times

each decade. Herbicides are sometimes needed to treat undesired invasive plants. These practices are typically employed on small areas of flat lands of under 4% slope where the erosion coefficients do not exceed the regional soil productivity guide. If these practices are proposed on steeper lands between 5-8% slope, the soil erosion tolerance factors are evaluated to assure consistency with erosion and productivity guidelines, as disking on slopes of 4-8% slope can produce about 4.5-to-11 tons/acre of soil loss (localized data from Dissmeyer and Stump, 1978). Disking on a regular schedule has estimated soil losses of 22-54 tons/acre on these slopes over a decade. Other individual treatments over time can add substantially to this soil loss, making fertilization, planting nitrogen-fixing plants, contour, leave strips, no-till, and other mitigation measures necessary to maintain soil productivity. Only a small portion of the soil loss typically leaves the site, as much is deposited within the treatment area or within adjacent forested buffer strips.

Restoration of cane breaks may include a thinning to a low basal area and two prescribed burns per decade. Estimated erosion is about 1.23 tons/acre/decade for slopes averaging 2% slope in the piedmont. If the thinned trees are girdled and not removed, the effects are only about 0.08 tons/acre/decade for two low intensity burns.

Water bird developments typically modify the existing hydrologic conditions on small to moderate size areas, typically 10-20 acres with unusual sites reaching 50 acres in size. In some instances, these may affect the migration of aquatic species and the distribution of some species such as freshwater mussels that rely on a specific fish species for part of their life cycle. High concentrations of water birds can produce problem levels of water pollutants that may be of concern in some instances when discharged into streams or in municipal or community water systems (Dissmeyer, 2000). Developments that use water levels and other less intensive methods to manage native and desired non-native vegetation species are more likely to have lower effects to soils and water quality than those that cultivate, disc, or employ frequent soil disturbance to control plant species. Since access to these areas is needed during construction, the effects of about 0.1 mile of road per acre of water-bird-habitat developed were included in the estimate of effects below.

Wildlife Management Effects by Alternative

Wildlife management activities include constructed and maintained openings, water bird developments, and canebrake restoration that range upward from Alternative G, which has the least erosion with 1,200 tons/year. Alternative B has 2,900 tons/year; I, 4,400 tons/year; A, 4,599 tons/year, D, 4,600 tons/year; E, 6,700 tons/year; and F, 7,400 tons/year over the first decade. Addressed with other units and spread over the national forest, these values range from 5-13 tons/square-mile/year, which is equivalent to 0.1-0.2 tons/acre/year.

The sediment effects of wildlife activities to water resources were included with other activities estimated at watershed scales in the water quality effects section using the regional sediment model (Clingenpeel, 2002) and applying localized erosion coefficients (Hansen and Law, 2002).

Recreation Management

Roads and trails for accessing areas are a part of recreation management, but these effects were discussed in a previous section. Developed and concentrated use sites expose and compact soils, alter surface and subsurface water flow patterns, and can alter stream channels during and following construction. These activities can increase erosion, sedimentation, and runoff. Occasionally ATV, horse, and other uses do not stick to designated trails and cause increases in soil exposure, compaction, displacement, erosion, sedimentation, and productivity loss. Reclamation of these impacts is costly and detracts from other management activities.

Riparian and stream areas are often a desired focal point of many recreational activities. People love the sights, sounds, life, and movement associated with streams and riparian habitats. However, riparian areas and streams are often very sensitive in a physical and biological sense to many activities that people enjoy. Activities involving concentrated people or animal uses, heavy equipment or horses, generally create problems in riparian areas because compaction or entrenchment produces effects due to limited drainage and excessive holding of water. Damage to tree roots from compaction can reduce health and increase mortality. Indirect influences in some areas include increased erosion, sediment, and stream temperature. Some of these effects can be minimized or mitigated.

Since many of the activities proposed in the forest plan result in impacts to the soil and water resources, the individual effects will be analyzed, compiled, and addressed in the following sections. Some effects will be included with the cumulative effects sediment assessment at watershed scales. Other scales may be mentioned, but are generally not addressed at great detail in this document. Local, onsite, and drainage or tributary scales will be addressed as appropriate with project level activities. At this watershed or landscape scale of planning, the following discussions may seem somewhat general in nature, more qualitative than quantitative, more inclusive of the major activities with less attention to minor ones.

Recreation Management Effects by Alternative

The effects of recreational use roads and trails were included in the roads and trails section. Estimated effects based on recreation use from developed sites (PAOT) and dispersed uses indicate that Alternatives F, B, D, and G have the least use with 800 tons/year. Alternative I has 1,900 tons/year and Alternatives A and E have 2,300 tons/year over the first decade. Addressed with other units and spread over the national forest, these values range from 1-to-4 tons/square-mile/year, which is equivalent to 0.002- to-0.01 tons/acre/year.

The sediment effects of recreation to water resources were included with other activities estimated at watershed scales in the water quality effects section using the regional sediment model (Clingenpeel, 2002) and applying localized erosion coefficients (Hansen and Law, 2002).

Watershed Improvement

Stabilization and revegetation to native and desired non-native species to control erosion and implement other best management practices should be given high priority. Revegetation helps to stabilize slopes, reduce streambank erosion, and improve hydrologic function to promote infiltration and water storage into the soil. Soil productivity will be improved on about 800 acres per year of severely eroded lands (McKee and Law, 1985; McKee et. al., 1995).

Watershed improvement projects should focus on stabilization and revegetation of actively eroding gullies, galls (barrens), streambanks, old access and logging roads, log landings, illegal OHV trails, etc., particularly for watersheds and streams on South Carolina's 303(d) and 305(b) lists of impaired or concern streams included in the state's Clean Water Action Plan. Emphasis is given in Management Prescription 11 for all alternatives to protect and improve floodplains, wetlands, and riparian areas, as well as reduce impacts to species at risk. Protection of municipal water source areas, along with public health and safety, should also be priorities. Based on past Watershed Improvement Program accomplishments under the current forest plan, an average of about 150 acres of degraded/declining sites would be treated each year for alternatives E, F and I, with treatment varying from 125 acres/year in alternative G, 175 acres/year in alternatives A and D, to 250 acres/year in alternative B.

Elements of forest health can be correlated with soil quality with respect to occurrences of various diseases (e.g., littleleaf disease) and different pests (e.g., southern pine beetle). Poor soils and nutrient status affect tree growth and mortality. Deficient soils increase moisture and nutrient stress, which in turn increase susceptibility to insect and disease infestations (Briggs, 1993).

Restoration activities on some of the active gullies include reshaping to stable landforms. Practices such as bulldozing, KG blading, ripping and disking are sometimes used to treat these problem areas. A variety of stabilization and erosion control measures have been utilized (Hansen, 1991, 1995; Hansen and Law, 1993, 1996, 2000; Feltman et. al., 1996; Law et. al., 2000). Treatments intend to maintain long term cover for erosion control and soil building purposes. Short term treatment effects for gullies or other lands needing reshaping can produce soil losses of 4-to-50-plus tons/acre if not aggressively grassed and/or reforested. Erosion rates are lessened dramatically within just a few years, and some of the most successful treatments return to near natural levels in just 2-3 years. This program has produced long term recovery of extremely poor and barren sites to sites that grow fully stocked stands of 8-12 inch pine timber in 12-18 years. More recent treatment areas include native plants and trees as part of the desired results. Once restored, noticeable erosion is seldom evident on-site or in downstream areas. Atypical circumstances such as drought or intense rainfall are monitored and sites get added treatments including fertilizer, seed, and mulch, as needed, until recovery is achieved.

Estimated erosion effects by alternative for soil and water improvement activities must take into account the estimated erosion if treatments are not used, and the temporary-to-

short term effects of treating the areas and result in long term improvements. Over the decade there is a net reduction in erosion from the activities.

Watershed Improvement Effects by Alternative

Alternative G has the least reduction in average erosion with -1,000 tons/year. Alternatives F, E, and I have -1,200 tons/year; Alternatives A and D have -1,400 tons/year; and B has -2,000 tons/year. Most of these activities are concentrated on the severely eroding lands in the piedmont, especially the Enoree Ranger District.

The sediment reduction benefits of the watershed improvement program on water resources were not included with other activities estimated at watershed scales in the water quality effects section.

Erosion

Soil erosion, the detachment and transport of individual soil particles by wind, water, and gravity, is a serious form of resource loss. It both reduces soil productivity and when delivered to streams as sediment, may lower the potential of the aquatic ecosystem including physical, biological, and chemical processes. Erosion is a natural element of the forest ecosystem initiated by disturbance factors such as wildfire, flood, wind, and other events.

A significant factor contributing to the amount of soil loss associated with surface erosion is the amount of bare soil created by an activity. With exposure comes the potential during rainfall and runoff events for soil dislodgement and movement. Other important factors in estimating the extent of soil erosion include soil texture, surface root densities, organic matter, infiltration rates, slope length, and slope (Dissmeyer and Foster, 1984). Revegetation of barren areas can reduce soil loss to negligible amounts between the third and fourth year (Dissmeyer and Stump, 1978). Erosion damage associated with vegetation management operations can be prevented by avoiding soil exposure and associated impacts or can be limited through erosion control measures. Limiting the area disturbed and exposed helps to control erosion. Litter, duff, and humus organic layers and the live fine root mat at-and-near the soil surface offer tremendous protection to the soil. Organic materials also promote maintenance of soil macropores, water absorption, and storage.

Forest management objectives for soil erosion include controlling soil loss rates and minimizing delivery of suspended and settleable solids to receiving streams. This helps protect aquatic habitats and sustain soil productivity. To help achieve this, a forestwide management standard calls for limiting aerial disturbance (bare soil) to less than 15% of any vegetation project area (10% within streamside management zones) and revegetating bare soil areas within the first growing season. Management standards require all newly constructed, reconstructed, and maintained roads, temporary roads, landings and skid roads, and other similar soil disturbing activities to implement best management practices

(BMPs) to control erosion. Waterbars, energy dissipaters below culvert outlets, and revegetation help meet this standard. In addition, soil ripping or subsoiling is utilized when compaction impedes vegetation and growth. Measures such as these limit productivity loss from activities by controlling runoff and erosion.

Soil Loss and Erosion Effects by Alternative

Based on the total erosion estimates for probable activities by alternative, Alternative G has the least erosion from national forest management activities with 30,100 tons/year. Alternative D had 49,000 tons/year; B, 50,800 tons/year; I, 51,600 tons/year; A, 53,800 tons/year; E, 57,200 tons/year, and F, 58,700 tons/year over the first decade. Addressed with other units and spread over the national forest, these values range from 53-to-103 tons/square mile/year (see Figure 3-1 below), which is equivalent to 0.08-to-0.16 tons/acre/year.

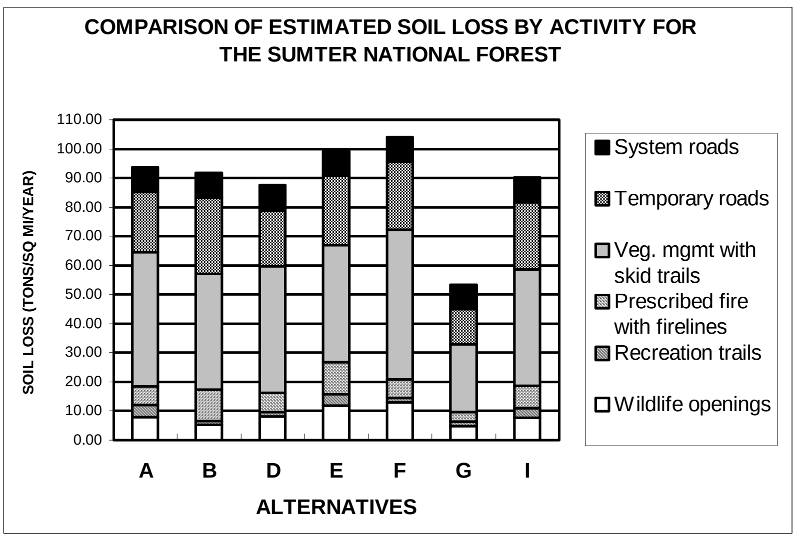


Figure 3-1. Soil Loss By Activity By Alternative

Soil displacement

The displacement of forest floor material can expose mineral soils, reduce nutrient supplies, lower available water, and increase soil densities, all of which are important to plant growth. Different soils have different sensitivities to displacement of surface layers due to variation in soil properties and qualities (e.g., topsoil depth, texture, structure, and stoniness) and other factors (e.g., slope, vegetative cover). The degree of displacement for a given activity often increases with slope until some point when other types of equipment and methods must be used to conduct the work. Soil loss can directly impair short- and long-term productivity because soil is a non-renewable resource. Root damage from skidding of logs and mechanical scattering may reduce tree vigor and resistance to disease and insect damage. Since fine root system mass concentrates in the upper foot of

soil, it's imperative that soil displacement be minimized to protect long-term productivity. Ratings for soil displacement potential are based on the projected sum of acres in construction of fire lines, skid roads and landings, temporary roads, system roads, and areas involved in mechanical site preparation. Detrimental displacement is the removal of the forest floor and 50% of the topsoil or humus-enriched surface soil from an area of 100 square feet or more, which is at least 5 feet in width.

Soil Displacement Effects by Alternative

Soil displacement or movement potential for all alternatives is the same ranking as presented in the erosion section above – from the lowest displacement to highest are Alternatives G, D, B, I, A, E, and F over the first decade.
Note: This is the correct arrangement 102503.

Compaction

Soil compaction can alter soil structure, reducing the larger pores and pathways in the soil, decreasing macropore space and soil porosity (macropores are soil voids > 14 micrometers), and increasing soil density. Compaction is not typically noticeable on the surface and often is most evident 12-18 inches below the soil surface. Compaction reduces productivity by retarding root growth as well as air and water/nutrient movement, exchange, and availability in the soil. Compaction reduces the volume of soil available for tree roots, breaking pathways that supply transfer of water and nutrients, and impedes root penetration and growth. In some instances, compaction produces a temporary to semi-permanent restricted layer upon which water ponds during wet weather and which remains saturated for extended periods of time. In these instances, further reduction of air to roots and availability of nutrients can be restricted, especially if anaerobic conditions develop as they would under wetland conditions. These effects can cause excessive mortality or hinder the health of trees planted or seeded into disturbed sites. Fortunately, minor to moderate compaction will eventually breakup over a period of years as regrowth occurs.

Effects from compaction vary depending on the degree of change in soil density with depth, soil-site-relationships, and any mitigation completed. Surface soil recovery from compaction can be relatively rapid from the periodic freezing, thawing (frost heave) in the northern- and mid-latitudes with severe winters, but may take decades at greater depths even where freezing is much deeper. Because macropore space is reduced by compaction, many changes occur to soil function. The loss in soil macrospace makes soil infiltration slower; requires less water to saturate the soil; reduces water available for plants; delays soil drying due to fewer plants transpiring water and greater capillary forces holding water; and restricts air interface with soil particles. Since there are fewer freeze-thaw cycles, soil recovery from compaction in milder climates is less rapid and generally takes decades.

Fertilizer application can accelerate recovery rates of roots in compacted materials. Wetting and drying cycles, growth of plant roots, microorganisms, and soil fauna combine to ameliorate compaction over time. Soil ripping can reduce compaction and increase survival and growth of new trees in heavily compacted materials, such as temporary road surfaces. In severely compacted terrain, ripping in both directions can be done to further break up the soil surface. Planting trees into the rips can prove beneficial as they tend to collect water and dislodged soil, but care must be taken to avoid excessive air pockets in the soil rips by compacting sufficiently around the trees. Even the best tillage is unlikely to return compacted soils to their original condition and productive potential for many years.

The extent to which a forest soil is compacted depends on the kinds of equipment used, the soil type, and moisture level of the soil. Equipment types, weight, number of trips over the same area, and the weight of materials moved or skidded can be varied somewhat to reduce ground pressure, and to determine whether concentrated or dispersed activity will produce the best results. Slash, litter, duff, and humus layers each offer some weight absorption benefits that help limit load bearing effort onto the soil surface. Soil texture, structure, and moisture content combinations produce a wide variety of specific conditions where soil compaction is more likely if activities are conducted. Designating skid roads can reduce the area of compacted soil with reduced soil productivity. Mitigation efforts would concentrate on those specific areas impacted. In some instances, the amount of compacted area can be reduced by dispersing skidding routes to only one or two passes throughout the harvest area. This approach may work well where heavy slash and dry soils limit compaction. Low ground-pressure skidders are also available to help reduce compaction when soil or moisture conditions are not ideal, but the activity needs to be accomplished. Winching logs to skidders rather than driving to each log from a skid trail can reduce compaction. Feller bunchers often are used in flatter terrain, and these can help limit skidding effects by sawing or shearing small to moderate size trees and placing into skid lanes. Slash from the fallen trees and limbs are placed on the felling and skidding trails to reduce the ground exposure and compaction. There is little damage to the residual stand as the skidder damage to roots and tree rubbing is decreased. Some compaction from the feller buncher may occur, but this equipment tends to be lighter and more maneuverable.

For some excessively drained, sandy soils, there are positive aspects concerning a moderate degree of compaction. In addition, compaction on roads and trails provides greater shear strength and load carrying ability that supports safer, more efficient access and use of heavy equipment, including log landings, ATV trails, etc. Compaction also helps prevent puddling in that most of the water runs off and the greater shear stress prevents the soil particles from combining with the water particles. Compaction, thus, helps to stabilize road surfaces and equipment use areas. This also helps reduce long-term maintenance costs. A well-compacted travel surface with drainage controls and gravel treatment (as needed) provides an excellent running/operating surface while reducing erosion, stream sedimentation, and dust abatement that may adversely affect air quality as well as adjacent flora and fauna. With heavy equipment, the travel surface may need a coarse base of cobbles and gravel for best support.

Compaction Effects by Alternative

Soil compaction commonly occurs with operation of equipment as well as dispersed foot traffic by humans and animals. Sometimes soils are compacted deliberately for good purposes such as in road construction. However, for purposes of establishment, growth, and health of forest and other desired plants, compaction can be detrimental, especially when soil densities exceed the growth-limiting threshold for root penetration. Compaction is avoided except for areas needing compaction such as roads and trails. Potential compaction effects were the greatest for management activities using heavy equipment, especially under moist soil conditions. However, most of the affected acres in all alternatives include intentionally compacted areas such as temporary roads, log landings/storage areas, primary skid roads, trails, recurrent use fire lines, etc. These areas are generally well dispersed and limited in extent; however, without mitigation they often produce a severe reduction in long-term plant growth and are irretrievable allocations of resources that are, more or less, dedicated to these uses, unless intentionally reversed by road decommissioning activities.

Soil compaction for all alternatives was estimated to be the same ranking as presented in the erosion section above, from the lowest displacement to highest are: Alternatives G, D, B, I, A, E, and F over the first decade.

Slope Stability

Slope stability problems are confined to primarily colluvial soils such as the Brevard soil series in the mountains. Slope disturbances produced by construction of roads, skid roads, and log landings, etc., can potentially initiate or accelerate existing soil mass movement or areas prone to instability by undercutting, hydrologically loading a slope, or disrupting established drainage patterns. Internal soil strength and external factors (e.g., root systems, ground water, bedrock type, and subsurface flow pattern) are important aspects of slope stability. Visible indicators of these conditions include misshapen trees, jackstrawed or leaning trees, cracks in the soil with exposed subsurface roots, and a series of steep and flat areas or rotational slumps across these areas (Hansen and Law, 1996). Road or trail building activities in these soils should consult soil, geology, engineering and/or hydrology specialists to evaluate.

Slope stability involves a complex interaction of soil shear strength, soil depth, slope gradient, groundwater rise – as related to precipitation – and tree root strength. Decisions regarding slope stability cannot be made without risk. All sloping soils seek to achieve a flat gradient over time, as influenced by erosion and landslide events. Assessments of stability and risk/hazards should be correlated with geologic formations/bedrock types frequently associated with slope failures (e.g., characteristics such as competency or rock strength, lithologic discontinuities, hydrogeological conditions/hydraulic conductivity and porosity, weathering, clay mineralogy, and strike and dip of beds). Risk ratings of ”severe or moderate” do not necessarily indicate an imminent or incipient failure. Such ratings mean only that slope adjustments are likely, especially if slope or hydrological modifications associated with road or trail cutting, filling, and compaction on these soils

alter the groundwater flow within the area or the slope support from excavating and removing materials. In some instances, where crossing these areas are critical, toe slopes can be supported with riprap, wall buttress, or similar method, and subsurface drainage can be brought to the surface by installing perforated drains into the slope.

Slope Stability Effects by Alternative

The potential risk for conducting activities on unstable slopes is low for each alternative because of the limited terrain in this hazard (2,250 acres of Brevard soil series in the mountains). Other small areas with slope stability problems less than 5 acres in size exist, but were not mapped on soil inventories. Where found, they are typically on localized areas of slope changes near streams, at the base of slopes or certain lithologic contact zones.

Soil Productivity

Extensive areas of the Sumter National Forest were severely impacted by past cultivation practices. The resultant severe erosion remained unchecked for extended periods of time and left considerable areas denuded, with deficiencies in nutrients, water retention, and ability to grow plants. Efforts have been underway for decades to treat these declining watershed lands, reducing areas of gullies and other severe erosion and regaining the growth potential on nutrient deficient lands though selective fertilization. Continued needs include the maintenance of plant cover, increasing root density, organic matter, and depth of the surface soil. However, rebuilding the soil surface may take centuries for full recovery to develop.

Activities that may substantially and/or permanently impair productivity of the land include road and trail building, cultivated openings, utility corridors, campgrounds, parking lots, etc. Activities that impact productivity can do so in a variety of ways when they alter and degrade soil quality or impair the soil's capacity to perform functions needed in the sustaining of plant and animal productivity. Usually when productivity losses are discussed, these effects remain as long as the facility is used. However, these effects can be reversed to some extent with treatment and sufficient time. There are irretriveable commitments of resources for these areas, but though severely altered, they are not irreversible commitments if sufficient resources and time are allocated.

Productivity Effects by Alternative

Productivity effects estimates can be very complex. Recognizing that erosion is but one element of productivity to consider, total erosion estimates are still the best indicator of overall productivity changes for the alternatives. Based on the total erosion estimates for probable activities by alternative, Alternative G has the least erosion from national forest management activities with 30,100 tons/year. Alternative D had 49,000 tons/year; B, 50,800 tons/year; I, 51,600 tons/year; A, 53,800 tons/year; E, 57,200 tons/year, and F,

58,700 tons/year over the first decade. Addressed with other units and spread over the national forest, these values range from 53-to-103 tons/square mile/year, which is equivalent to 0.08-to-0.16 tons/acre/year.

In addition, fertilization of impoverished lands of 70 site index or less is used to improve soil productivity. In comparing the alternatives, the least number of acres would be improved in alternative G at 500 acres/year (A/Y), and most in alternative F at 1,000 A/Y. Estimates of treatments for other alternatives include I, 700 A/Y; D, 720 A/Y; E, 750 A/Y; B, 780 A/Y; A, 820 A/Y.

Watershed improvements to gullied and severely eroding lands mentioned earlier also provide marked increases in productivity and the ability of the soil to support healthy plants, maintain soil cover and increase organic content. Alternative G would treat 125 acres/year, 150 acres/year for alternatives E, F and I, 175 acres/year in alternatives A and D, and 250 acres/year in alternative B.

Cumulative Effects

Soil Productivity

Compaction, displacement, erosion, slope stability, and nutrient status all influence soil productivity. For this reason, assessing overall soil productivity was selected as the best indicator of cumulative effects. Elements of the individual components may be addressed, but this is an overall assessment of the cumulative impacts to soil productivity from the forest plan revision alternatives. Most soil effects occur on-site or on areas close-by. Therefore, these effects will concentrate on what is happening to the soils on the national forest and immediately adjacent areas, and not be discussed at landscape or watershed scales which are being handled in the riparian, water, and watershed discussions.

The forest management activities with the greatest long-term potential impact to soils are associated with construction of roads, log landings, primary skid roads, timber harvest on steep slopes using conventional equipment, and actively cultivated openings, especially those that exceed 3-4% slope. Heavily compacted areas such as roads have permanent losses in productivity unless efforts are undertaken to close, rip the road surface, and use erosion control and revegetation methods to mitigate the effects, which will occur with temporary roads with treatments, and with time.

Temporary productivity losses are dispersed across timber harvests and other activities that use heavy equipment on the landscape. These losses reduce with time, revegetation and mitigation measures such as fertilization, seed, and mulch. Mechanical site preparation and frequent or hot prescribed burns can also reduce soil productivity over time, especially when associated with steep slopes or severely eroded soils. Activities that are combined with others, especially when conducted frequently, need careful evaluation and attention to sensitive soil types. These complex combinations can reduce productivity and may go unnoticed unless specifically evaluated. Potential productivity

losses can normally be mitigated or minimized if calculations of erosion or nutrient loss indicate that further testing is necessary. Soil and vegetation observation and physical and/or chemical tests are sometimes used to verify specific problems. Besides mitigation measures to designated areas affected, natural responses such as the establishment of native grasses, trees and nitrogen fixing plants help to reduce these effects.

Effects from these activities vary with soils, but soil loss and erosion are the basis of evaluating soil productivity losses. The tolerable forest soil losses vary somewhat by soil type and slope conditions (Region 8, 1982). For most combinations of activities on the highly productive flat lands under 5% slope, erosion is minor and productivity losses are considerably less than forest and regional standards. For most of the low to moderate slopes with average productivity, no more than 85 tons/acre of soil loss should occur over a 100-year period. The Regional Guide allows for short-term loss up to 10% of this total or 8.5 tons/acre/year. Long-term combinations of treatments over a planning horizon should not exceed 43 tons in 50 years without mitigation or other changes to limit these losses. These estimates are based on the average and better piedmont and mountain soils. Poor or heavily eroded sites can loose only about one-half of these amounts and maintain productivity. Specific mitigation measures can be developed to limit or offset the productivity losses. Maintenance of native plant cover provides a permanent deterrent to erosion and productivity losses. Fertilization can offset nutrient losses or increase in cycling and mobility rates from soil mixing and/or exposure. Other mitigations that lower and offset erosion rates increase permanent cover, limit soil exposure, reduce soil disturbance, and/or increase root density and organic content in surface soils. Efforts to lower erosion relative to the erosion factors associated with the Universal Soil Loss Equation, typically target actions that avoid or mitigate concentrating flow (i.e., altering slope, slope length); limit disturbance and maintain a high degree of soil cover with leaves, organic surface and root density (i.e., provide low C factor); and encourage soil development (i.e., reduce soil K factor).

In the short term, the alternatives disturbing the greater area in compacted surfaces and those that rely on utilizing the steeper slopes associated with that activity will potentially generate the larger short-term reduction in productivity from excessive soil loss and disruption of infiltration and nutrient cycling within the soil. In ascending order from least to greatest potential for productivity losses within the first decade, would be Alternatives G, D, B, I, A, E, and F over the first decade. Soil and water improvement actions that benefit watersheds are lowest to highest in Alternatives G, E, I, D, A, F, and B over the first decade. However, with implementation of prescribed management measures (i.e., revegetation of bare soil areas, maintenance of native plant understories, thinning, partial cutting, stage regeneration, contour tillage, no-tillage, reducing frequency of activity, altering season of treatment, etc.), the short- and long-term cumulative effects from erosion would be for most activities, within tolerable soil loss rates that are needed to sustain productivity.

In regards to compaction, much of the affected area occurs in areas allocated or otherwise designated for future use (e.g., roads, trails, log landings, primary bladed skid roads, fire lines for frequent burning cycles, high use recreation sites) in support of long-term

management objectives (e.g., timber harvest, wildlife habitat improvement, recreation). Compaction above the projected growth-limiting bulk density for a particular soil (1) which extends more than 4 inches in depth; (2) where there is a 20% or greater reduction in macro-pore space; or (3) where there is a 15% increase in bulk density, residual long-term effects will likely be present in the foreseeable future. On compacted sites mitigated by mechanically ripping or subsoiling compacted soils, fertilizing and revegetating them can help to reverse this effect as plant roots help break up compacted soil with time.

Compaction often concentrates at depths below the surface of 12-to-18 inches, so disking is often not sufficient to mitigate the effects of compaction. Indentations in the soil surface are not necessarily a sign of compaction; they are more typically a sign of rutting or displacement that occurs in wet soils. Rocky or coarse sandy soils show limited effects from compaction. Clay soils tend to hold water and displace rather than compact. However, the silt dominated soils tend to provide the most problem. Compaction cannot be seen from the surface, and some soils are more of a hazard for compacting than others. Severe compaction should be ripped at depths of 18-24 inches in one or both directions to breakup the compacted soil layers. Special ripping teeth are designed and spaced specifically to improve breakup of compacted layers. Ripping should not be used under wet or moist soil conditions, as these soils deform rather than rip. Ripping on the contour is recommended when used on sloping terrain, and the practice may also be used to help break up problem soils where the existing fragipan or hard pan is near the surface on relatively flat to moderate slopes, affecting root and water penetration, plant health and surface erosion. Where affected areas aren't adequately restored following compaction impact, soil density will slowly revert to normal levels based on the frequency of freeze-thaw cycles, plant root penetration, soil microorganisms, earthworms, moles, etc. It would not be unusual to expect some effects of the soil compaction to linger for decades if treatments are not employed to break up the compaction.

Cumulatively, environmental consequences to soils from past, present, and foreseeable actions are minimized through careful planning, design, implementation, and monitoring. Most adverse impacts will be low-to-moderate. Activities that alone or combined with other actions tend to produce a high level of impact are restricted to flatter slopes and soils where the degree and extent of impact is lessened to acceptable levels. Therefore, long-term soil productivity losses will produce irreversible effects on only permanent roads, where mitigation over time is not expected. Other combinations of activities that have the potential for long-term productivity loss will be evaluated and mitigated as needed.

Watersheds, Streams, and Water Resources

Affected Environment

For the most part, watershed discussion at this coarse forest plan scale will be about the 28 hydrologic units (HUs) called fifth level watersheds that intersect the Sumter National Forest. Each watershed is identified and typically ranges from 40,000 to 250,000 acres in size and has a numeric code. The term watershed is sometimes also used generically to

refer to activities that relate to soil and water improvement or to refer to a hydrologic unit of no specific size. When possible, the appropriate hydrologic unit size will be used such as basins (third level HUs), subbasins (fourth level HUs), watersheds, subwatersheds (sixth level HUs), drainages (seventh level HUs), subdrainages (eighth level HUs), etc., to address small to moderate-scale hydrologic units. Area and project level analysis may include or reference small to moderate scale HUs, but generally concentrate on large scale to site specific conditions. The fourth and third order tributaries referred to as "*Drainage Basin Response Units*" (Patterson, 1981) in the 1985 plan generally coincide with the eighth and ninth level HUs and typically contain perennial flow (Hansen, 2001). The branching of the stream network extends to second and first order streams, and sometimes further densifies in severely eroded areas. The headward extent of stream systems is estimated by using the USGS contour map crenulations, but field verification is needed to determine the stream types and extent (Hansen, 2001, Meyer et. al., 2003).

The lands of the Sumter National Forest were acquired primarily under direction contained in the Weeks Law of 1911. This law instituted improvement of impaired lands to provide sustained forest and water resources for the Nation. Most were "The Lands that Nobody Wanted" (Shands and Healy, 1977). Severe surface erosion and formation of gullies and galled barrens affected much of the landscape (Schumm et. al., 1984). Much has been accomplished over the last 70 years to improve watershed conditions on the Sumter National Forest.

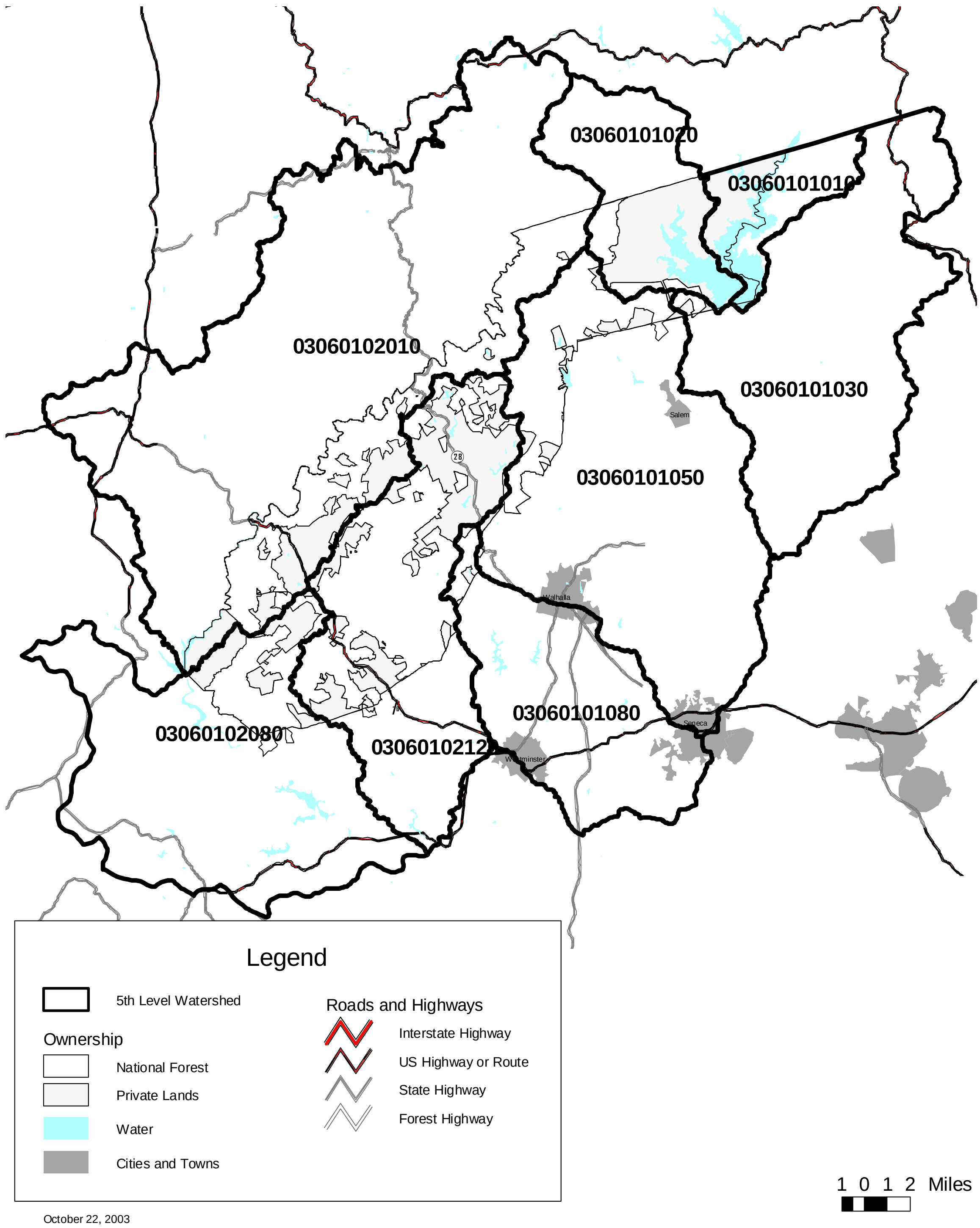
Improvements to watershed conditions have occurred on both national forest lands and, to a lesser extent, on private lands. Many of the once actively eroding gullies, galls, and roads on the national forest have been stabilized and/or restored to normal function (Hansen, 1991, 1995; Hansen and Law, 1996; Law et. al., 2000). On private lands, major land-use shifts from intensive cropping to forest and pasture uses have improved the soil management and hydrologic function of the landscape. Increased attention to BMPs and conservation practices in South Carolina are common (Hook et. al., 1991; Adams and Hook, 1993; Adams, 1994, 1996; Jones, 2000). However, some of the residual effects of past actions are hard to remove totally.

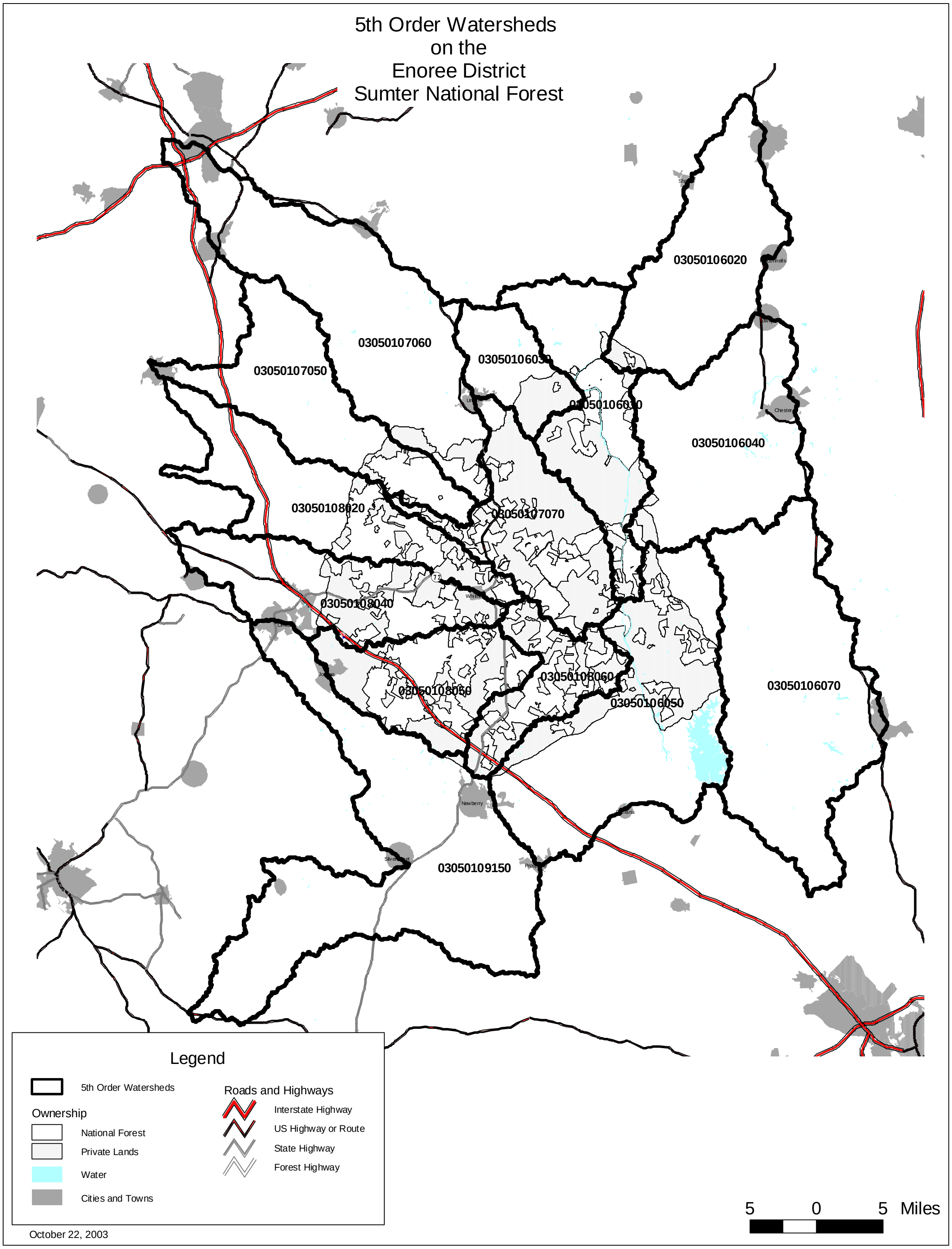
Alluvial valleys below extensively eroded lands in the piedmont were filled with sediments, and many streams are still adjusting (Happ, 1945, Trimble, 1974, Hansen, 1991, Alexander, 1993). Rosgen G type gully channels are deeply entrenched into the alluvial sediments (such as Isaacs Creek, Enoree Ranger District (RD), Figure 3-2) (Rosgen, 1996). Deep entrenchment causes reduction in flooding to alluvial terraces. Many of these terraces remain as riparian areas due to the abundant, well dispersed rainfall, extensive network of streams and colluvial slope interface that contribute surface and subsurface water to maintain soil moisture and riparian species. Channel scouring and widening processes continue as some channels evolve to either reach their original base level or approach stability at a new level. As the valley gully channels widen with associated instability of the streambanks, entrenched Rosgen F type channels emerge with high width to depth ratio character (such as Pattersons Creek, Enoree RD, Figure 3-2). When the lateral changes subside and streambanks stabilize, internal adjustments of channels may rebuild a small floodplain within the F terrace confinement into Rosgen C

type channels (such as lower Pattersons Creek, Enoree RD). Urban, development and other activity within some drainages are showing signs of channel aggradation and increased flooding of riparian areas in some valleys, possibly a result of renewed sources of sediment, increased flows and/or adjustments due to legacy sediments. Examples of this include Tinkers, Headleys and Indian Creeks, Enoree RD (Hansen et. al, 2003).

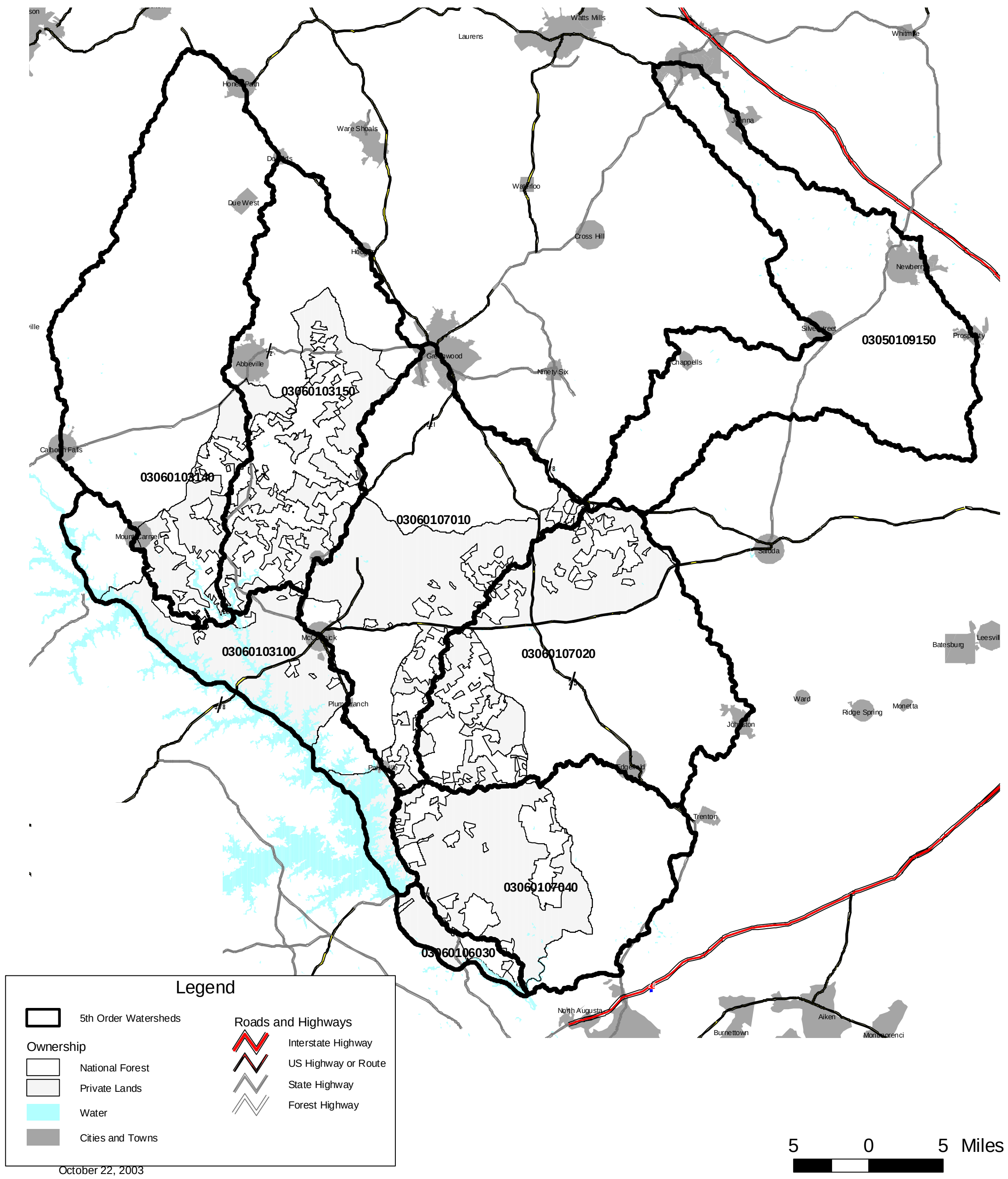
Figure 3-2. Small perennial streams Isaacs Creek (left) and Pattersons Creek (right) show roots and trees in their entrenched channels that were once buried by sediments from severely eroding hillslopes and gullied terrain. They are indicators of the modern valley elevation that was buried in the late 1800s to early 1900s. Isaacs Creek is widening, but remains a Rosgen G5 (gully) type channel with low width to depth ratio and dominated by sand size particles (Wolman, 1954), while Pattersons Creek is a Rosgen F5 channel with relatively high width to depth ratio and dominated by sand size particles.

5th Order Watersheds
on the
Andrew Pickens Ranger District
Sumter National Forest




5th Order Watersheds
on the
Enoree District
Sumter National Forest
03050106020
03050107060
03050107050
03050106030
03050106010
03050106040
03050108020
03050107070
03050108040
03050108060
03050106050
03050106070
03050108050
03050109150
Newberry
Legend
5th Order Watersheds
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
5 0 5 Miles
October 22, 2003

5th Order Watersheds
on the
Long Cane Ranger District
Sumter National Forest



Rainfall, Streamflow, and Water Yield

Average annual precipitation on the Sumter National Forest varies from about 45 inches in the piedmont to 70 inches in the mountains. Rainfall is well dispersed throughout normal years which helps to maintain flow in some small second order streams and most that are third order and larger (Hansen, 2001). Rainfall frequency data indicate that rainfall intensities in the southeastern United States are much higher than average and among the highest in the nation (Hershfield, 1962, NOAA, 2003). Average annual water yield on the forest ranges from about 10 to 20 inches from the piedmont with the southern portions of the Long Cane Ranger District the lowest and the northern portion of the Enoree Ranger District the highest (USGS). Water yield in the mountains ranges from about 30-50 inches with lower amounts in the southwest at lower elevations and higher amounts in the northeast at higher elevations (USGS). Yields vary annually based on storm events, climate, and water uses within watersheds. Severe storm events are infrequent and are sometimes generated at localized drainage scales with summer thunderstorms. At broader scales, inland storms that develop from hurricanes and tropical depressions can interject copious amounts of moisture in the air, which may release moisture as it rises and cools in passing over the land, or as the warm moist air is pushed upward by cool passing weather fronts. Average annual water yield for SNF is approximately 760,000 acre-feet or 1.03 billion tons of water.

Streamflows are typically lowest during summer months into August or September and highest during winter months in December through March. Weekly minimum flows for 2 year return periods for Long Cane Ranger District streams are typically 0.1 to 0.2 cubic feet per second per square mile (CSM), with Enoree Ranger District ranging from 0.1 to 0.26 CSM and Andrew Pickens Ranger District from 0.5 to 2.0 CSM (Zalants, 1991). Weekly low flows that return on an average of 10-year intervals are about 40-70% of these values. Smaller drainages typically have a higher minimum flow rate per unit area than larger drainages. Some reasons for this lower flow per unit area for larger drainages are: 1) more water uses such as irrigation can be found along larger drainages; 2) added evaporation and transpiration by riparian plants; and 3) coarse, deep substrates may contain subsurface flows that are not observed or measured during low flow periods. These low – or in some instances interrupted – flows may give a competitive edge to specific types of aquatic organisms that are able to survive or live within the channel substrate, or take advantage of interrupted pool habitat maintained by subsurface flow. Extreme low flows on many streams occurred during the extended drought from 1996-2001 that ended in above normal rainfall during the spring and summer of 2002.

The magnitude and frequency of rural floods in South Carolina can be estimated using standard hydrological techniques (Guimaraes and Bohman, 1989, Feaster and Tasker, 1999). These estimates can be refined when needed by selecting individual station data for the area of concern (Hansen, 1989). Flow duration curves can be developed for the long-term stations that can be used to predict flow duration on adjacent areas. South Carolina normally benefits from rainfall throughout the year, so the extent of perennial and intermittent streams is much greater than many areas of the United States. In addition, the extent is also well beyond the blue lined streams identified on the 1:24,000

scale topographic maps published by the US Geologic Survey (Hansen, 2001, Meyer et. al., 2003).

Groundwater

Groundwater occurs locally as no major aquifers exist in the mountains or the piedmont. Surface water is the main supply of water for consumptive and non-consumptive use to communities and local public water supplies, however individual wells often supply enough water for rural private home use. Use of groundwater on the forest is limited to primarily administrative sites including hunt camps and campgrounds. Currently, there are wells at 28 administrative and recreation sites with 13 sealed wells no longer used and abandoned, and 1 domestic spring at Moody Springs picnic area on the Andrew Pickens RD. In an effort to limit private uses affecting the National Forest, there are no domestic wells or springs currently under special use permit.

Water Rights and Uses

South Carolina water right law is based in the riparian doctrine, which allowed reasonable water use as part of landownership, as long as that use did not infringe upon other property owners and their use. Information concerning amounts and types of water uses compiled by the South Carolina Department of Health and Environmental Control (1995) is included in the cumulative effects discussion.

Non-consumptive uses of surface water resources comprise most of the on-forest demand for water. This use includes recreational activities (such as swimming, fishing, and boating) on streams, lakes, and reservoirs and power generation from reservoirs. Important non-consumptive uses include the flows needed to maintain aquatic habitats and for channel maintenance. Maintenance of flow for scenic waterfalls, river floaters, swimmers, hikers, and campers is important to many mountain as well as piedmont visitors. Waterfall spray zones provide some special habitat needs.

Consumptive water uses on forest (such as industrial or municipal withdrawals) are negligible. Administrative uses for water include needs for fire suppression and control, water to maintain plants during periods of drought, road needs for dust abatement and to meet compaction specifications, and small impoundments or water retention areas for recreation, fishery, aquatic and wildlife uses. There are several special use authorizations for water transmission including water transmission pipelines for the SC Parks, Recreation and Tourism, City of Union, Newberry County, Bradley Community Association, a road watering company, and an individual. Three special use permits are also noted in the mountains for small reservoirs with portions within or structures such as spillways on the National Forest. In the mountains, Westminster, South Carolina, obtains its municipal water source a short distance below the Sumter National Forest boundary in the Chauga River, with a backup source in Ramsey Creek. Watersheds north of Coneross Creek contribute to Lake Keowee, which is the municipal water source for Greenville and Seneca, SC and the Oconee Nuclear station. The Walhalla Fish Hatchery returns most of

the water diverted from Indian Camp Fork or East Fork Chattooga River for temporary uses within their trout and fish breeding tanks. Several domestic water uses are provided from springs or small streams to private individuals as requested under special use permit.

Municipal water uses in the vicinity of the Long Cane Ranger District include McCormick, SC from Lake Thurmond and North Augusta, SC and Edgefield County from the Savannah River. Municipal uses adjacent to the Enoree Ranger District include Whitmire, SC with source in the Enoree River with Duncan Creek as a backup source; Union, SC, Lockhart Mills and Carlisle Cone Mills are supplied by the Broad River. Columbia, SC is also supplied by the Broad River a substantial distance downstream.

There are about 15 small ponds and reservoirs averaging about 5-10 acres in size within National Forest boundaries. Most are older structures that have poorly maintained dams that will need heavy maintenance practices to remove trees and repair damage that has occurred over extended periods of time. There are also many privately owned ponds on adjacent lands that have some influence on forest streams. The dams that are owned and managed by the National Forest were constructed or obtained through acquisition or, land exchange and used for a variety of recreation, wildlife and fishery uses. Hydrologic modifications have a variety of effects on water quality, flow regime, and aquatic habitats (Glasser, 2000). Through cooperative agreements, some of the adjacent small privately owned dams in the mountains have been retrofitted for bottom releases to reduce the effects of surface warm water discharges on trout and other aquatic species in the summer months. There are several small hydrologic control dikes within major river floodplains that were developed specifically for waterfowl habitat. Water sources may include tributary streams, water diversion with control structures, and unregulated sources from river overflow channels, sloughs, tributaries and groundwater seepage. Some have employed intermittent pumping of water to or from nearby streams and rivers to try to better control water depths within the structures to meet desired water control needs. Where these activities concentrate attract abnormal wildlife populations, excessive levels of water pollutants may accumulate. Mitigation in design and discharge may be needed to limit contamination from pollutants such as nutrients, fecal coliform, pathogenic organisms (e.g., *Escherichia coli*, *Cryposporidium* spp., *Giardia* spp.) (Nadareski, 2000; Scatena, 2000; Stern, 2000; Tiedemann, 2000). Discharge permits are obtained when required. Natural influences to channel hydrology and chemistry are increasing from the impoundment and diversion expansion of the beaver throughout much of the stream network. Beavers have expanded flooding of local valley and channel areas, causing changes in riparian vegetation, streambank stability and water quality. Road culverts are sometimes plugged by their handiwork. Their dams are damaged from time to time by flood events. Changes in stream temperature, turbidity, sediment, fecal coliform and other contaminants may occur due to the changes in hydrology and biologic uses.

An increase in the public demand for water is anticipated in the future. The high quality waters from the national forests in general are expected to be in increasing demand to meet local community and recreational needs for both consumptive and non-consumptive water uses. The effects, both positive and negative, can be very complex associated with

these added demands for water development and use. South Carolina has recognized the potential need for a better water management system to keep pace with this emerging issue. Proposals to alter streams and riparian areas affecting the National Forest require close scrutiny to address public and environmental concerns.

Streams

Perennial stream densities are higher in the humid southeast, especially in the mountains, than many other areas of the Nation. Using the Chattooga River watershed as an example, stream density by type was estimated at 2.9 miles of perennial, 1.7 miles intermittent, and 5.6 miles ephemeral streams per square mile (Hansen, 2001). Stream densities may vary somewhat with the other watersheds in the mountains and piedmont. The piedmont has gullied and galled lands with additional drainage density that cannot be picked up at 1:24,000 scale maps and this level of detail cannot be included in these estimates. The drainage density of the piedmont is similar to the mountains, but the perennial stream extent is likely somewhat less in the piedmont due to lower rainfall rates, with some resultant increases in the amount of intermittent or ephemeral streams.

Rosgen stream types common to the mountains are B, A, and G in hillslope and higher gradient valley terrain, with F, and C types in low gradient valleys (Rosgen, 1996). Dominant stream channel materials are typically sands, gravels, cobbles, and less common are boulder or bedrock substrate. Valley types are somewhat confined and develop from steep to moderately sloping dissected terrain with alluvial, colluvial, fluvial, and residual soils. Some streams have controls from past geologic faulting and folding of predominantly metasedimentary materials. In a few instances, substantial shear fault lineaments such as the Brevard Fault align and confine portions of Brasstown Creek and the Chauga River. Years ago, log splash dams were used on the West Fork Chattooga, Chattooga and perhaps a few other rivers to move logs for processing at the mill. When the dams were broken, the water volume coursed through the channels and moved the logs like a huge water sluice to the mill or to a stream access point, causing extensive channel and bank erosion, sedimentation, and river alignment adjustments. Some channel obstructions were removed with dynamite to prevent log hangups.

Piedmont stream types are commonly Rosgen G and F stream types with infrequent B and A types in hillslope dominated terrain. Streams in broader valley bottoms are often Rosgen F or C types, occasionally G, and less commonly E and D types with dominate substrate materials being commonly sands, occasionally gravels, and infrequently, cobbles or bedrock. Alluvial valley types are low to moderately sloping with moderate to high hillslope drainage densities. A few instances of stream segment alignment due to geologic faulting are present, though much less frequent and for shorter distances than in the mountains. Saprolite parent materials are a result of the deeply weathered geology in the warm, humid subtropical climate, making thesoil C horizon and residual geologic materials more erodible. Past farming and development activities have produced extensive deposits of alluvial material in valleys from severe surface, hillslope, and gully erosion (Happ, 1945, Trimble, 1974, Schumm et. al., 1984, Hansen, 1991, Alexander, 1997). Surface erosion was a dominant feature across the landscape, averaging nearly a

foot of soil loss with modern valley deposits about four to ten feet thick that aggraded streams, buried valleys and increased flooding. However, conversion of substantial areas of eroding farmlands to forests tended to reverse the trends that overwhelmed streams with sediments, allowing the processes of stream channel incision into the recently deposited alluvial and fluvial soils.

Channels continue to adjust in the gullied headwaters and alluvial valleys. Episodes of entrenchment, bankfailure, widening and deposition continue to actively modify stream sections through time. Improvement is occurring, but equilibrium and stability are slow in coming. Channel entrenchment, low to high width-to-depth ratios, and unstable streambanks are common features across much of the piedmont landscape, especially on the Enoree RD.

Due to both natural and human efforts in reforestation, revegetation, and stabilization of the land over the last 70 years, many drainages have improved soil infiltration, which has helped to lower runoff to more normal levels. Conversion of hardwood dominated terrain to agricultural uses in the 19^{th} and early 20^{th} centuries increased water yield and stormflow, but likely reduced low flows. During recovery of formerly agricultural land to pine dominated forests on the SNF, lower water yields and stormflows resulted from a combination of the increased infiltration and evapotranspiration. Reforestation and soil building have improved watershed condition. Streamflow and runoff coefficients are moderated and closer to normal levels found with stable forests. Conversion of pine forest conditions back to hardwoods or native pine species, adding increased areas in savannah, woodland and wildlife opening management will increase water yields to some degree, causing localized channel adjustments within areas of concentrated activity. These changes are moderated by protecting the soil surface, and allowing controlled and relatively slow changes to drainages and watersheds over time.

Watersheds

On a regional scale, the Ranger Districts of the Sumter National Forest appear as three dots within the South Atlantic-Gulf Hydrologic Region. The Enoree District is within the Santee River Basin, connected through the Broad and Congaree Rivers, and includes the Lower Broad River, Enoree River, and Tyger River subbasins, intersecting 14 watersheds. The Andrew Pickens and Long Cane Districts are within the Savannah River Basin that includes areas within the Tugaloo River, Seneca River, Little River, Stephens Creek, and Lower Savannah subbasins, intersecting about seven watersheds on each district. The 28 fifth level hydrologic unit code (HUC) watersheds that contain some national forest lands in South Carolina vary in size from 21 to 335 square miles. Each of the hydrologic units is defined and numbered in the state HUC maps, which are being adjusted to meet new national criteria.

Many of the specific attributes of the watersheds were summarized in the Broad Scale Watershed Analysis for the Sumter National Forest (Hansen et. al., 1999, 2002). See Appendix M for a summary of the information collected during this analysis. More detailed information on the USDA Forest Service watershed analysis process in Region 8

can be found in Watershed Analysis – A Proposed Process for Forest Planning (Holcomb et. al., 1999). The Sumter watershed analysis included some information from Watershed Water Quality Assessments of Savannah and Broad River Basins by the South Carolina Department of Health and Environmental Control (DHEC Technical Reports 002-93 and 001-98). **The watershed analysis process for the SA forests focused in on sedimentation, addressed in more detail within the process records (Clingenpeel, 2003a, 2003b, Hansen and Law, 2003).** Most of the watersheds contain only a minor portion of National Forest System lands.

Pure or classic watersheds are hydrologically self-contained. Those classic watersheds with 15% or more national forest lands include Chattooga River, Chauga River, Indian Creek, Duncan Creek, Long Cane Creek and Turkey Creek (within Stevens Creek subbasin). After all classic watersheds are identified across a landscape, there are leftover portions or remnants of the landscape that typically are made up of smaller drainages within intermediate or lower sections along a river. These areas are called composite or remnant watersheds in that they are not self-contained hydrologically as one or more watersheds contribute to them. These remnant watersheds were given unofficial names to help describe their relative location to each other within the national forest. Those residual watersheds with over 15% national forest ownership include Lower Enoree River, Middle and Lower Tyger River, and Lower Savannah River. Subbasins are fourth level HUCs representing the next smaller scale hydrologic units and typically contain 4 to 6 watershed units. At larger scales, the fifth level watersheds are also divided into smaller hydrologic units called sixth level subwatersheds. Finer divisions are possible to drainage, subdrainage, and tributary units. For more detailed areawide or project level work, these are mapped in detail within the SNF boundary based on prior stream ordering and drainage analysis (Patterson, 1981). In a few instances, this mapping of fine hydrologic units has extended to full watersheds with substantial national forest presence (Hansen, 2001, Hansen et. al., 2003).

Watersheds were selected as an analysis unit because much of what is known about forest ecosystems was derived through the study of small hydrologic units called drainages or catchments. It is interesting to note that some of the ancient cultures studied water movement, streams, and watersheds to help solve problems of their day. Water was recognized as a key element in daily life, providing drinking fluids, transportation, food, and recreation. The study of hydrologic information is no less important today. Watersheds not only combine many elements of the hydrologic cycle, but many aspects of nutrient and energy cycles are linked to hydrologic functions. Not surprisingly, water pollutants are also heavily correlated with water cycles.

The early study of hydrologic phenomena was based on careful selection and instrumentation of study drainages (American Geophysical Union, 1965). Watershed experimentation began in forest and pasture land in Switzerland (Engler, 1919) and in the United States at Wagon Wheel Gap, Colorado (Bates and Henry, 1928). For extended time periods, hydrologic studies collected information on responses to environmental conditions and forest management (Hibbert ,1965; Bormann and Likens, 1969; Hewlett and Pienaar, 1973). Wilm (1944), Ward (1971), Toebes and Ourgvaev (1970), and others

provided reviews of watershed experimentation concepts, techniques, and analyses. Some of this information will be considered as the reference watershed conditions are characterized, studied, and compared to managed watersheds.

Discussions about hydrologic units are more defined today because advances have been made in delineating and describing the hierarchy (NRCS, 2003). Once learned, this helps to reduce confusion and communication problems dealing with hydrologic scale. The Hydrologic Unit Code was developed nationally for mapping and differentiating hydrologic units by region, subregion, basin, subbasin, watershed, subwatershed, and if necessary, finer scales. Each level has two digits that describe their relative position in the hierarchy, with watersheds being the fifth level with ten digits. The fifth level hydrologic units or watersheds are a primary communication and analysis tool that is currently being used for analysis of roads and watershed conditions.

Water Quality

All major streams and many important tributaries on the forest are classified by the State of South Carolina *Stream Classifications for the State of South Carolina*, South Carolina Department of Health and Environmental Control, 2002. The stream classifications from most to least restrictive include categories of Outstanding National Resource Waters (ONRW); Outstanding Resource Waters (ORW); Trout-Natural (TN); Trout-Put, Grow, and Take (TPGT); and Freshwaters (FW). As of the most recent streams classified, there were no ONRW streams identified, but the Chattooga is a likely candidate. Much of the Chauga and Chattooga Rivers including many tributary waters and Tamassee Creek are currently designated ORW, with special areas designated for TN, and TPGT (SC DHEC, 2001). Any remaining waters are classed as FW. All stream classes have standard restrictions designed to limit water quality effects and protect beneficial uses. In South Carolina, these standards are typically related to water chemistry and toxic pollutants. Suspended sediment has not been evaluated to become a water standard, but turbidity, a surrogate for suspended sediment, is sometimes applied. All classifications include indigenous populations of aquatic organisms as a use to protect and maintain. Water classifications for ORW, TN, and TPGT have special restrictions in addition to FW stipulations to insure protection of the specific resources. The ORW designation applies the antidegradation rule, and trout waters are especially concerned about maintaining adequate dissolved oxygen and cool-to-cold temperatures. In addition, more restrictions are prescribed in recovery plans by the U.S. Fish and Wildlife Service for any waters identified with endangered aquatic species, such as the endangered Carolina heelsplitter (*Lasmigona dicorata)*, a freshwater mussel found in areas of the Stevens Creek subbasin.

Water quality data collected by the U.S.G.S. and State of South Carolina indicate that surface water quality generally meets most of the standards set for uses of streams, rivers, and lakes for general public use and wildlife management. However, many of the streams, especially those within the Enoree Ranger District, are listed by the State of South Carolina as impaired due to elevated fecal coliform levels. Intense storms may produce sediment laden and fecal contaminated waters, especially in the piedmont and below agricultural, pasture, development, and urbanizing areas that are common

components to most watersheds. River rafting and water contact sports could be affected by fecal contamination and excessive sedimentation within portions of the Chattooga Wild and Scenic River (Hansen et. al., 1998). Individual stream sections may also be impacted by other specific water quality concerns.

The South Carolina Department of Health and Environmental Control has identified other types of water quality problems for some stream reaches. These problems include some wide ranging, but sporadic, mercury problems across the state as well as some localized pollutants that are associated with point discharges or unknown sources. Copper, zinc, and chromium, likely from industrial or urban sources, affect a few stream sections. Water quality reports that summarize many of these water quality deficiencies are available by subbasin and stream section from the state in subbasin reports and 303d and 305b lists. Where impairments exist, efforts to cooperate with the state to identify, prioritize and formulate Total Mean Daily Loads (TMDLs) to reduce the pollutants to acceptable levels.

Water quality is a concern on the national forest and it has been impacted by past and current activities from various land uses. Current problem stream conditions are summarized below. The approximate percentage of perennial streams identified as impaired by fecal coliform or other pollutants by the state are presented in Table 3-1.

Table 3-1 . Approximate percent of perennial streams impaired with excess fecal coliform or other pollutants by watershed (from SC 303d and 305b lists, 1998)

Watershed number	**Watershed surname**	**Percent of Perennial Streams Impaired**
0305010601	Upper Broad	77
0305010602	Turkey Creek (Broad)	95
0305010603	Browns Creek	97
0305010604	Sandy Creek	92
0305010605	Lower Broad River	0.03
0305010607	Little River Broad	0
0305010705	Middle Tyger	96
0305010706	Fairforest Creek	94
0305010707	Lower Tyger River	54
0305010802	Middle Enoree River	97
0305010804	Duncan Creek	98
0305010805	Indian Creek	98
0305010806	Lower Enoree River	98
0305010915	Middle Saluda River	0
0306010102	Whitewater River	0
0306010103	Upper Keowee	0
0306010105	Little River Seneca	0
0306010108	Coneross Creek	98
0306010201	Chattooga River	28
0306010208	Tugaloo River	0
0306010212	Chauga River	0
0306010310	Little Savannah Composite	0
0306010314	Little River - Savannah	0
0306010315	Long Cane Creek	0
0306010603	Lower Savannah	53
0306010701	Upper Stevens Creek	35
0306010702	Turkey Creek	6
0306010704	Lower Stevens Creek	0.12

Primary types of water quality impairment in South Carolina include exceeding standards for fecal coliform and in a few instances, water chemistry as mentioned earlier. Fecal coliform are the indicators of fecal pollution. In themselves, fecal coliform are not specifically hazardous to human health, but they are used to indicate the level of risk or possibility that other more dangerous polluting organisms may be present, such as *Cryptosporidium*, *Giardia*, *Escherichia coli*, *Legionella*, and *Salmonella* species (Scatena, 2000; Stern, 2000; Dissmeyer, 2000).

Inadequate municipal, community, and individual wastewater and sewer collection systems and grazing or other animal uses are a major concern for individual sections of many streams (Zipperer et. al., 2000, Buckhouse, 2000). Wildlife and pets need to be included with potential sources of water contamination. Elevated fecal coliform and other contaminants in stream systems often occur in relation to rainfall-runoff events as pollutants are dislodged and washed into the stream network. When utilized, forested buffers have proven effective in reducing these and other contaminants in streams.

Sediment

Erosion and sediment are major issues in this analysis as many of the activities on the national forest and private lands disturb the land surface, may accelerate soil loss and erosion, deliver sediments to streams, and may affect water quality, riparian, and aquatic habitat. The extent of erosion and sedimentation from roads and forest management and related land use practices have been estimated in the past (Roehl, 1962; Dissmeyer and Stump, 1978; Yoho, 1980; Swift, 1984). Some of these efforts were applied for forest and project level planning and analysis (McLaughlin et. al., 1981, Goddard, 1982 and Hansen et. al., 1994). However, these efforts concentrated more on hillslope and small drainage conditions on the National Forests, rather than addressing watershed scale activities that included private lands within larger hydrologic units. Estimates of sedimentation for land uses were evaluated by watershed in this analysis to consider relative changes from the past and existing conditions, estimate differences in alternatives and to help evaluate the impact on aquatic health which is discussed later in the Aquatic Habitats section (Clingenpeel, 2002, 2003, Scott et. al., 2003; Hansen and Law, 2002). The estimates were based on baseline and existing erosion-based sediment rates at watershed scales and were compared for each alternative. Baseline levels were based on erosion measured by Dissmeyer and Stump (1978) in mature forests by employing the Revised Universal Soil Loss Equation to erosion factors collected for many areas and activities across the Southeastern United States. Existing estimated erosion was calculated in the Region 8 sediment model (Clingenpeel, 2003) for current land use and management activities that occur with each watershed based on soil loss, erosion and sediment coefficients localized to South Carolina rainfall, soil and slope conditions in the mountains and piedmont areas (Hansen and Law, 2002) and the Dissmeyer and Stump (1978) C factor data associated with different activities. The amount of erosion delivered for each watershed used a sediment delivery ratio based on the area of each watershed to determine the amounts delivered Roehl (1962). The details behind the estimates are provided in the process records. Actions designed to prevent or mitigate erosion and improve water quality such as BMPs would likely reduce these values, as the Sumter

National Forest and forestry industry have actively pursued ways to conserve soil and water resources and restore watershed conditions (South Carolina Forestry Commission, 1994, 1999, Hook et. al., 1991, Adams and Hook, 1993, Adams, 1994, 1996, Jones, 2000, McLaughlin et. al., 2002).

Sediment does not have a specific water quality standard in South Carolina that is used to delineate impaired waters in developing the 303d list; however, sediment is used in developing the 305b list where it has direct or indirect impacts on water quality or affects beneficial uses such as aquatic habitats. In a separate study by the Environmental Protection Agency relative to the Chattooga River, tributaries listed in South Carolina as sediment impaired, threatened, or to be watched (monitored) include Whetstone, Long, Fall, King Creeks, and the East Fork of Chattooga River. Turbidity standards are a surrogate to suspended sediment concentrations that may apply in some stream circumstances (SC DHEC, 2002).

Sources of sedimentation vary by watershed, but all ground-disturbing activities contribute to some extent. Agricultural cultivating, grazing, highways, roads, rural, urban and industrial development activities can have substantial impacts. Silvicultural activities that cause erosion and sedimentation include construction and maintenance of permanent and temporary roads, log landings, and skid trails. Since normally only small percentages of the soil surface are exposed in logging activities, non-road or trail related erosion is typically minimal. Only a very small portion of sedimentation can be attributed to landslides and debris flows generated by road construction, skidding, or maintenance and use of roads and trails on colluvial terrain. Much of the sediment input results from eroding road surfaces, slopes, and ditches, particularly those in the proximity of stream channels. A substantial portion of open roads that are bladed, scraped, or otherwise maintained can expose soils and fine aggregate materials to increase erosion and sediment. In addition, similar types of effects come from highways, major collector, and arterial roads that are used for many other reasons where interstate commerce, recreation, occupational, and other human needs for access exist.

In most watersheds, recreational activities are directly or indirectly affecting water quality to some extent. Water can be a critical part in many recreational experiences. Effects of these activities on the Chattooga River will be discussed in another section. Recreational traffic on most of the open road system has a weathering and disturbance impact to the road surface, requiring frequent maintenance of gravel or in some instances, natural road surfaces for safe and efficient access. Off highway vehicles (OHVs),all terrain vehicles (ATVs), and equestrian trails have locally increased stream sediment loads and adversely affected aquatic biota. The intensive OHV, ATV, and horse uses are being mitigated through frequent trail maintenance measures. Off trail or unauthorized uses are often causing problems wherever they are found by compacting, exposing, displacing, and disturbing soils, thereby increasing erosion and sedimentation. Mountain bike and hiking trails can produce erosion and sediment, but their narrow surface and less intense surface impact from normal uses make them easier to maintain and less susceptible to severe erosion.

Activities such as stumping, root raking, debris piling, cultivating, disking, and scarifying related to wildlife openings can expose soils and increase erosion and sedimentation. Since most of these occur on regular cycles, but on relatively flat slopes under 8%, former agricultural lands on river terraces, and on closed road surfaces, erosion and sediment potential are elevated, but generally are not high as long as quality cover is developed and maintained, and mitigation measures are used.

Many streams in South Carolina are impacted by excessive fecal coliform levels. Camping areas, river uses, fishing, and dispersed uses in close proximity to streams, also increase the opportunity for pollution. Without provision for human or other wastes, recreational uses can contribute to pollution and create temporary and intermittent impacts to water quality. User education and commitment to leave-no-trace is important to maintaining the high quality stream experiences.

Chattooga River and River Uses

Much of the Chattooga River affected environment is provided in chapters 3 and 4 of the forest plan in management area and wild and scenic river descriptions. There currently is no flow data or stream gage at any location other than the Highway 76 bridge. Average daily flow records at that station (USGS station number 02177000) are based on average daily flows from October 1939 through September 2001. About one-half of the time, the flow is **524** cfs or greater. Mean daily flow is **648** cfs with a standard deviation of **530** cfs. The lowest average daily flow on record was **88** cfs in October 1954, and the highest daily is **14,800** cfs. The highest instantaneous flow on record was 29,000 cfs on August 30, 1940. Much more detail in flow duration is available, but not summarized here.

The two primary water quality issues identified relative to river uses were fecal coliform and fine sediments. Temperature is a secondary concern within the Chattooga watershed as elevated temperatures affect trout and other aquatic species distribution. From past water sampling and flow records by USGS, State of Georgia, EPA, and USDA Forest Service, Stekoa Creek produces over one-half of the sediment and fecal loading within the Chattooga Watershed. Total maximum daily load (TMDL) for sediment has been set by the EPA for sections of Stekoa Creek, Warwoman Creek, and West Fork Chattooga River (EPA, 2001). Other streams on the 303(d) list in Georgia for excessive sediment, fecal coliform and/or biota within the Chattooga Watershed include portions of Stekoa Creek including tributaries Scotts Creek, Pool Creek, Saddle Branch, She Creek and Chechero Creek, Warwoman Creek, and West Fork Chattooga River including tributaries Law Ground Creek and Roach Mill Creek (GA EPD, 2000). In North Carolina, Norton Mill Creek was included on the 303(d) for sediment due to biological impairment and monitoring will determine the listing and priority of treatment (NC, 2000). The Forest Service cooperates with the states, EPA, Counties, communities and interested publics relative to water quality issues and their resolution with TMDLs, BMPs, restoration or mitigation measures.

<u>Fecal coliform</u> is a water quality indicator of pollution associated with warm-blooded animals, including humans. Fecal material deposited on the landscape may get into

solution during storm events and may move to streams if not absorbed within filter strips, and filtered through soil. The fecal coliform levels within the Chattooga River and tributaries found during storm events are often high enough to be of concern to swimmers and to other water contact sports that are often present when floating the river. This is especially true of storms that are intense or that follow dry periods. The water quality in Stekoa Creek suggests that even non-storm periods are intermittently or perhaps even regularly contaminated by fecal materials (USGS stream data, Hansen et. al., 1998).

The actual extent of contamination by the individual potential sources has not been fully documented, but water quality tests conducted by the USGS show intermittent problems during storm events and added frequency and severity associated with large loads from Stekoa Creek and, to a lesser extent, other sources. The RNA methods are available to verify the types of contamination among human, cattle, geese, beaver, wildlife, and other sources. These tests would involve analyzing specific coliform levels in water samples to differentiate RNA indicators found from different fecal sources. The contamination of fecal material from the river use is difficult to estimate. It should be noted that during the warm periods with moderate flow levels, the equivalent of 5-10% of the Chattooga watershed human population is floating the river, increasing the potential for human waste materials within the river corridor. Probably many river visitors use existing waste disposal facilities. However, signs of disposal of human waste within the dry portions of the stream channel, as well as within the floodplain or terrace, are sometimes evident. Some of the fecal material will find its way into the Chattooga River system. Fecal coliform increases are well documented in association with storm events both in the Chattooga River and in streams that do not have the rafting uses. Without further study, the level of fecal contamination from the river or any other uses cannot be determined. Hansen et. al., 1998, discuss a summary of fecal problems and a variety of information sources relative to the Chattooga River, highlighting the past and ongoing severe fecal contamination associated with Stekoa Creek.

Other recent USGS information collected in 1997 provides more intensive fecal coliform sampling within the Chattooga River and major tributaries (figure provided previously). Unfortunately, only a few samples were taken associated with storms. Individual samples were taken in the Chattooga River at Highway 76, Stekoa Creek, Warwoman Creek, West Fork Chattooga River, and North Fork Chattooga River. Maximum values reported for these streams included 490; 54,000; 7,900; 3,300; and 230 MPN fecal coliform/100 ml, respectively. Except for the North Fork of the Chattooga River, all major tributaries were substantially greater than the allowed water quality standard for swimming that is set at 200 MPN/100 ml, with infrequent variances to 400 MPN/100 ml. All of the above readings except for the North Fork locations were taken during the June 12, 1997 storm under moderate flow conditions. During that day, the measured flow at the Highway 76 stream gaging station was 929 cubic feet per second (cfs). Further verification from the past data records shows elevated fecal contaminants, especially during storms in some of the tributaries are not uncommon, suggesting excursions above water quality standards are not unusual.

The direction in the 1985 forest plan relative to the concern over fecal coliform (on page M-9) has been only partially implemented. However, some improvements in waste facilities have been provided since 1985. The primary fecal contamination issue is from a health and safety standpoint associated with water contact sports such as swimming. A monitoring plan is needed to determine the effects of the activity on water quality and to identify the sources of pollutants for possible treatment or improvement. Those that float the river should be informed of the risks involved with swimming during and following storm events and also in swimming within problem reaches such as the river section below the confluence with Stekoa Creek.

<u>Sediment</u> - Mobile fine sediments of sand size and finer particles were sampled within the Chattooga Watershed (Van Lear et. al., 1995). They were composed primarily of medium to coarse sands (70-90 percent), followed by very coarse sands (5-25 percent) with very fine sediments (i.e., fine to very fine sands, silt and clay, 1-5 percent). Between Bull Pen and Dick Creek, 63 to 85 percent of the pool area were impacted by sands. Fine sediments are extremely impactive to fishery and aquatic habitats (Reiser and White, 1988, Platts et. al., 1989, Durniak and Rudell, 1990). Erosion and sediment levels are normally high, to some extent due to the high rainfall, well-weathered soils, and steep and dissected slopes. Historic timber harvest, roads, skid roads adjacent or within stream channels, splash dams, farming, mining and other practices add to the current legacy sediment sources that contribute to the high sediment levels within the Chattooga River and many tributaries (Alger, 1994).

The banks of the river are entrenched and steep, with bank erosion problematic in some locations due to past or current disturbance. However, most areas are stable, with forested slopes dominant and narrow floodplains built over time. Substantial portions of higher gradient channel areas are dominated with bedrock, boulder and cobble materials. Lower gradient sections, pools, glides, point and side bars have gravel components with a dominating trend of light to heavy sand deposits adhering to mossy growth and covering areas of slack water including stream margins and floodprone areas. Recreational impacts include road and trail crossings and sometimes paralleling stream channels, banks, and campgrounds and parking areas in the immediate vicinity. Recreational activities may expose soils and/or dislodge fine particles from the streambank and streambed. River users may stir-up some fine sediment in the margins of the channel as they get in and out of rafts, which can contribute to localized turbidity and sediment levels. This disturbance is most noticeable during lower flow levels, and generally quickly dissipates in most cases, as the particles move downstream to redeposit on the margins or in pool areas. Large particles suspended for short durations during storm events are often termed “bed load.” Finer particles are suspended for extended periods during and following storms events, and are most commonly referred to as suspended sediment. Sediments that are smaller in size than medium sands have impacts to a variety of aquatic species (Braatz, 1993). These sands are mobile, abrasive to algae and other organisms, and can clog and limit benthic flow properties that are needed for the health of some organisms.

Van Lear et. al., 1995, reported only small portions of the total suspended solids in tributaries were made up of fine sand and smaller materials. However, the sediment

levels within Stekoa Creek are of special concern because the magnitudes overwhelm the lower channel with sediments, producing over half of the Chattooga watershed sediment load (USGS data, Hansen, 1993). Visible turbidity and sediment accumulations are evident, especially during and immediately after storms. Sediment plumes and excessive sediment cover the channel and marked accumulation on all depositional features including pointbars, sidebars, and flood-prone areas.

Temperature is a concern relative to the river and related to the extent of trout habitat and other aquatic species. Temperature was not included as an issue of the river uses since the likelihood of a cause and effect relationship is low. Most of the temperature increases are natural for a wide shallow channel. Although there are few ponds on tributaries within the watershed, some have been retrofitted for bottom releases to reduce the effects in the summer months.

Riparian resources: Wider portions of the floodplain and terraces that are accessible are sought out by river floaters and used for picnics and camping. Except for the river access points that must cross riparian areas, these camping and picnic areas are the most likely to be impacted by river users. Impacts include soil exposure, damage to riparian vegetation from compaction, and sometimes, soil erosion. Some of the formerly farmed bottomland river terraces continue to be used for wildlife openings and maintained in early successional habitats. These generally are on low gradient slopes and offer low to moderate risk for sediment. Where these infringe into the primary streamside management zone, concerns besides sedimentation may include stream temperature, solar effects on stream vegetation, large woody debris recruitment, herbicides, pesticides, and bank stability are evaluated.

There are floodplain areas contained within the extent of riparian areas, but probably few if any wetlands. Most, if not all, of the riparian areas are well drained alluvial deposits and develop riparian, but do not develop wetland soil and plant communities. None of the activities being used or proposed would likely damage floodplains, but some elements of EO 11988 may be appropriate to consider if facilities are located within the floodplain. Protection of river users and property is needed by signing floodplain hazards at known use areas and by displaying flood hazard zone in river maps or other informational materials on public camping sites, parking areas, designated river access, or recreational use facilities.

Some riparian vegetation and soil impacts are possible from concentrated uses, such as access. These uses can generally be limited in extent and impact through quality design and location, regular monitoring, maintenance, and mitigation.

Potential Creek Floating Use above Highway 28: Water quality and stream information for the North Fork Chattooga subwatershed was summarized by Hansen (1998). The Grimshaws Road 1107 crossing (NC) has a drainage size of 7.98 square miles and Highway 28 crossing (GA/SC) has 66.4 square miles (Hansen, 1998). These are 4% and 32% of the drainage area of the stream gage at Highway 76. Since there are no stream gages at the potential put-in points, one can roughly estimate the flow by taking these

percentages times the Chattooga at 76 site. This may give a conservative estimate, as more rainfall and runoff may occur in the headwaters. Based on the Chattooga flow duration curve for duration of 0.05 (about 18 days per year) and 0.1 (about 36 days per year) percent chance of flow exceedance, Grimshaws flows 50 and 38 cubic feet per second (cfs), respectively. The North Fork at its mouth flows about 500 and 380 cfs for those durations. In other words, about one month each year the average flow is above 50 at Grimshaws and 500 cfs at Highway 28.

Other potential access points between Grimshaws and Highway 28 include Bull Pen Road 1178 (NC), Burrells Ford Road 708 (GA/SC), and possibly hiking the trail from the end of Big Bend Road 709 (SC). Foot traffic has access along much of the river with Bartam and Chattooga River trail, Chattooga Foothills trail, and Ellicott Rock trail.
The North Fork Chattooga subwatershed is about 97% in forest land uses with about 1% each in exposed soil or rock, pastures, and forest edge/shrub. Elevations range from 1,576 to 4,902 feet, with the Grimshaws Road 1107 access at approximately 2,800 feet, Bull Pen Road at 2,400 feet, Burrells Ford Road at 2,000 feet, and Russell Bridge (Highway 28) at 1,600 feet. Numerous water monitoring site stream data are available for various tributary drainages in this section of river. The North Fork channel at Highway 28 is described as a Rosgen F3 channel from the entrenched cross section with moderately high width-to-depth ratio measurements. Some obvious sand sediments (40%) were documented in the riffle/run section measured for particle size distribution. Low bank erosion and scouring were noted at the site. The subwatershed was listed in South Carolina Salkehatchie-Savannah Water Quality Management Strategy (SC DHEC, 1993) as an unimpaired water with notable trend in fecal coliform and turbidity with poultry farms and silviculture listed as potential causes and is being studied for NPS-BMPs for waste reduction and further evaluation on the turbidity concerns. Current impaired 303(d) lists have delisted some sites as they refine the process to identify and verify waters with major problems. Several of the drainages contributing to this site were sampled in the Van Lear study. Many tributary Chattooga sites sampled had relatively good water quality with generally low to slightly elevated storm total suspended sediment concentrations as compared to Stekoa Creek, Big Creek (West Fork Chattooga) and Whetstone Creek that had much higher total suspended solids during storm events. North Fork Chattooga River benthic macroinvertebrates were sampled in conjunction with the Chattooga Demo and rated excellent with a NC biotic index of 3.03 for qualitative samples (Weber and Isley, 1995). Sampling aquatic macroinvertebrates in 1986 (site C9) indicated a very good rating using diversity indices (English, 1987).

North Fork fecal coliform data that are available indicate likely past problems with contamination in the subwatershed in the late 1960s and early 1970s at the Grimshaws and Bull Pen sampling locations (Hansen, 1997). Fecal colifom levels in the thousands had apparently diluted to hundreds by Burrells Ford with some rebound in numbers below the West Fork. Limited data in the 1970s and 1980s suggest that the problem activities have been taken care of or they are intermittent and difficult to sample.

Chattooga River at Grimshaws (NC) has a drainage area of less than 8 square miles. The land use is dominated by forests (92%) with 3% bare or developed, 1% pasture, and 2%

shrub/edge, and includes about 27 miles of road. Sampling aquatic macroinvertebrates in 1986 indicated very good rating using diversity indices (English, 1987). Fecal coliform data available indicated some likely past problems. The location is the upper boundary of the Chattooga Wild and Scenic River Corridor. The Chattooga at Grimshaws was rated as a Rosgen F1a channel (Hansen, 1998). The entrenched, high width-to-depth ratio channel is bedrock dominated and was affected by fine sediments in both pool and riffle sections. Please refer to Appendix H for a further discussion and analysis of this issue.

Direct/Indirect Effects

Water Quality

Hem (1960) provides an excellent review of the chemical aspects of water quality. Slight changes in water chemistry may occur relative to forest management, but the research shows that these typically are minor or short lived. Some pollutants from vehicles may eventually make their way into the water column with storm events or wash off when streams are forded. Although once an issue before streamside management zones were instituted, stream temperature effects for most activities are negligible. Fecal coliform effects can emerge where concentration of people, animals, or wildlife occur. Turbidity and sediment continue to be major effects on water quality as many forest management activities contribute to these.

The effects of erosion and sediment are a major part of the forest plan analysis, Issue 4 on Riparian Area Management, Water Quality, and Aquatic Habitats. Delivery of erosion to streams is referred to as the sediment delivery ratio as quantified by Roehl (1962) in the inverse relationship between sediment delivery and hydrologic unit size. Sediment delivery of erosion into intermittent and smaller streams with drainage areas of 5-50 acres is within the 50 to 70% range, and about 35% for small perennial streams with areas of about 200- 400 acres (Roehl, 1962; McLaughlin et. al., 1981; Hansen, 2000). For watershed scale areas of 40,000 to 250,000 acres, Roehl's average sediment delivery ratio reduces to 11 and 6%, respectively. However, substantial variance exists in Roehl's data, as well as some differences between physiographic areas that should be noted.

The highest sediment rates occur during the larger rainfall events. However, it is typically the storms with an average frequency of about 1.5 years, often referred to as bankfull flow, that actually define channel morphology (Rosgen, 1994). Over time, these less severe, but frequent events probably move the most sediment. Less frequent floods such as a 100 year event may have higher sediment loads, but the bankfull flow occurs nearly every year and sometimes more than once in a single year, enabling it to move higher quantities of sediment with time. Bankfull flow also keeps the channel scoured and relatively free of perennial vegetation in most circumstances.

Much of the sediment deposited in stream channels originates between what is delivered to headwater streams and what remains in suspension at the watershed boundary and is used to form point bars or may be deposited in the channel or onto floodplains. Sediment management is a natural, ongoing process in streams. Streams in balance with their

sediment loads manage to process and sort the materials, building and renewing habitats, depositing the finer particles on the stream margins, in pools, and in floodplains. However, if too much sediment is delivered, the system can become overloaded, resulting in changes in habitat, channel capacity, channel morphology, and flooding. Excessive sediment begins by causing active channel deposits that can fill pools, converting them to runs, and reducing aquatic habitats. When deposits are overwhelming, channels adjust by aggrading, initially developing side and internal bars and eventually changing form. Continued excess sedimentation develops to a braided condition from sediment accumulation and loss of sediment moving forces due to more frequent out of bank flows. Many of the functions and habitats are lost under the braided stream circumstance (Rosgen stream type D). Braided streams are infrequent on the Sumter National Forest, but localized sections are sometimes found where moderate to steep gradient channels with high sediment loads meet low gradient valley conditions. During the active gully formation period, many valleys may have developed this braided stream character because the supply of sediments so greatly exceeded the streams ability to carry it (Happ, 1945, Rosgen, 1996). In most instances, once the supply of sediments subsides, the stream will begin the process of reversing this trend with the entrenchment and widening processes discussed earlier.

Water Quality Effects from Activities

Like soils, ground-disturbing activities may produce effects to water quality. A portion of the erosion effects in the soil section reach streams and can have an influence on water quality and aquatic habitats in the form of sediment. Major areas of activity that disturb the ground and produce sediments include: 1) roads and trails, 2) vegetation management, 3) fire management, 4) wildlife management, 5) recreation management, and 6) soil and water improvements. Other management areas have activities of lesser extent such as mining, utility corridors, dams, river use, and other special uses that can influence water quality. As mentioned, many of these effects can be avoided, minimized, and mitigated.

Direct effects to water quality typically are related to road, trail, dam, dike, fish structure, debris installation or removal ,and other types of ground disturbing or heavy equipment construction that occurs within or immediately adjacent to streams. Most of these direct effects are avoided when possible or minimized in BMPs, forest standards and implementation guides (McLaughlin et. al., 2002). Where appropriate, necessary permits are obtained to operate within navigable streams, active channels, floodplains, and connected waters. Adjustments to plans ensure consideration of avoidance, minimization, and mitigation alternatives or actions. In addition, adherence to any state and federal permits or direction that regulate activities and sediment controls are required. Mining, utility corridors, construction, recreation, and river use can produce erosion, sedimentation, and/or channel changes that are addressed in detailed activity plans.

Indirect effects to water quality from activities are typically a result of rainfall and runoff sequences that deliver soil particles and other pollutants to streams. Pollutants come from a variety of sources including vehicles, people, pets, animals and equipment as they

cross streams, expose soils, and change the surface vegetation cover, soil, or hydrologic functions. These non-point sources of pollution are dispersed with time and location, and may not enter streams unless specific events or conditions occur. Pollution from roads, trails and recreation has been discussed in other sections. Dams and dikes alter surface hydrology and need regular attention to maintain the structure. Without regular maintenance, weakening and eventual failure could result, as well as added effects to water quality and downstream areas. Water quality effects vary with the structure and location, but include changes in dissolved oxygen, aquatic organisms, chemical and sediment balance (Glasser, 2000). In addition, water birds and some terrestrial species affect the biological, nutrient, and chemical quality of water (Nadareski, 2000). Care in designing projects to protect from failure during flood events, such as limit return flows and manage pollutant release are helpful.

Stream chemistry effects from forest management practices are typically minor and temporary, but can be affected by activities such as vegetation harvest, vegetation conversions, prescribed burning, fertilization, and pesticide applications (Stednick, 2000; Landsberg and Tiedemann, 2000). In all of the alternatives, stream buffering designed to protect water quality from most forest management is included with SMZs and forest standards in Alternative F; and with SMZs, the riparian corridor prescription and forest standards in the other alternatives. Activities within the riparian corridor will consider effects to aquatic systems, avoiding or minimizing effects where possible.

Erosion can be a good indicator of water quality change from activities, recognizing that erosion reaching streams varies with the width and effectiveness of stream buffers (Swift, 1988). Delivery of erosion varies by position on the landscape, with the locations closest to hillslope processes getting the highest delivery rations. In small intermittent and scoured ephemeral streams, delivery may be 50 to 70%, with about 35% delivered into small perennial streams and below 10% at watershed scales (Roehl, 1962). In addition, average annual water yield from the national forest is over 1 billion tons of water that aids in the suspension, dilution, transport and deposition of most of the sediment (Hansen et. al., 1994). Preventative or mitigative measures such as BMPs, standards and guidelines can be very effective at limiting the delivery of sediments into streams.

Water Quality Effects by Alternative

Erosion delivery as sediment is the major factor that can contribute to water quality and habitat decline, but it is certainly not the only element of water quality. Some pollutants adhere to soil particles in the erosion and sediment delivery processes. Other pollutants may be altered in some way due to the presence or absence of sediments. However, total erosion estimates are probably one of the best indicators of overall water quality change to be expected on the forest in evaluating each of the alternatives. Based on the total erosion estimates for probable activities by alternative, Alternative G has the least erosion from national forest management activities with 30,100 tons/year. Alternative D had 49,000 tons/year; B, 50,800 tons/year; I, 51,600 tons/year; A, 53,800 tons/year; E, 57,200 tons/year, and F, 58,700 tons/year over the first decade. Addressed with other units and

spread over the national forest, these values range from 53-to-103 tons/square mile/year (see Figure 3-1), which is equivalent to 0.08-to-0.16 tons/acre/year.

Assuming a sediment delivery ratio of 0.34 in headwater perennial streams, the average concentration increase among the alternatives based on approximately 1.03 billion tons of water yield produced on the Sumter National Forest each year would be 10 parts per million (ppm) in alternative G to 19 ppm in alternative F. At watershed scales with the average sediment delivery ratio of 0.07, the mean concentration change would range from 2 to 4 ppm. In the proposed alternative I, average impacts to headwater perennial streams would be increased sediment of 17 ppm and to watershed scales the mean concentration increase would be 3.5 ppm. So compared to fully implementing the 1985 plan (Alternative F - Current), the proposed action would produce a small reduction in sediment effects from the current alternative.

Water Quantity

Most water quantity or water yield changes in streams during the next planning cycle will be related to the road, vegetation, and habitat management. Water yield in streams typically increases permanently from road building and conversion from forests to grasslands. Temporarily, increases in flow may follow after timber harvesting or vegetation removal practices. Since pine forests produce more water than hardwood species, there are some increases in water yield as forests are converted to hardwood species. The following sections discuss some of the background information associated with water quantity increases from activities.

Roads and Trails

Substantial change in water yield may result from cutting and filling slopes to make a road or trail surface. Soil compaction of roads, log landings, trails, and other compacted surfaces impede infiltration and increase runoff. Most quick flow water increases from National Forest System lands are probably from roads. Compacted road surfaces probably contribute nearly 80-90% of the rainfall as water yield, much of which would be stormflow. Small or light rainfall events could have substantial surface absorption and evaporation, but large or intense events develop runoff. As water moves to the shoulder and into ditches and filter zones, much of it can be absorbed into filter strips if frequent drainage features are utilized as recommended in BMPs. Roads surfaces are typically only a small portion of large areas, so at large drainage to watershed scales, their effect on water yield is muted. At project or localized scales, roads can have a substantial effect on capturing and channeling excess rainfall, surface runoff, and, in some circumstances, subsurface flow along their path. Additions of road stormflow to local intermittent or ephemeral streams produces minor to substantial effects. A road across and draining into some small streams may not be just a small portion of the drainage area. With their ability to capture surface and subsurface flow along with providing substantial stormflow from their surfaces, roads can easily overload small drainages with excessive flow. These localized effects are most noticeable when the drainage structures in roads are not

frequent enough or in terrain where the channels have entrenched into saprolite or other unconsolidated materials. These effects are substantially reduced by strictly following BMPs, which utilize frequent water diversions of surface flows into the forested buffer zones, to dissipate much of the storm water effects that contribute to quickflow and these off-site effects. At the project level, road density and location can have extraordinary effects that will be evaluated at that level.

Vegetation Management

The temporary effects of removing vegetation or permanent conversion of vegetation types that intercept and transpire rainfall can influence water yield. Different types of vegetation have different rooting, stomata, leaf or needle coverings, and growth habits that can affect the amount of water utilized in evapotranspiration processes. In general, grass cover yields more flow than forests, and hardwood forests yield more than pine forests. So areas converted from forests to woodland, savanna, or wildlife openings will likely provide some permanent increases in flow. Timber harvest temporarily removes vegetation that transpires a substantial amount of water each year. The most notable changes in water yield from timber harvest is usually augmentation of summer low flows (Swank et.al., 1989), with lesser effects to peak stormflows. Much depends on soil and site conditions, storm intensity and duration, as well as antecedent soil moisture conditions (Lull and Sopper, 1965; Anderson et.al., 1976). The amount and duration of this increase also depends on the percentage of basal area (BA) removed as well as forest type. As mentioned earlier, road and other compacted surfaces can increase stormflow, but whether it shows up more as quickflow or delayed flows depends, in part, on the level of BMP implementation. Timber harvesting in pine generates a greater increase in total water yield than hardwoods or mixed pine-hardwood types. Return to preharvest water yields is typically within 10 years, as regrowth is rapid. Swank et al, 2000, noted that there was extra water use in fast growing stands about age 15-18, which might show up at a slightly younger age in fast growing areas of the piedmont. During this time, healthy pine stands are growing their fastest. The recovery of water yield enhancements from harvests will be quicker for partial cuts or thinnings, where trees are ready to take up and utilize much of the residual water. Harvesting in hardwood or mixed stands may produce many sprouts that rapidly grow and continue to transpire, dampening or shortening the water yield increases common to pine regeneration. In all alternatives, vegetation manipulation will include a combination of seed tree, shelterwood, thinning and partial cuts such as group selection or patch cuts. There will also be an effort to restore woodland and savanna habitats that will require thinning areas to about 40 sq. ft. basal area per acre for woodlands and 10-20 sq. ft. basal area for savannas. Prescribed burning will be used at frequent intervals on those areas to obtain native grass understories. In sloping terrain or areas with shallow surface soils, duff and/or humus, added measures such as sowing or planting native grass or other species may be needed to insure timely recovery of the site and conversion to suitable species.

When the water yield changes from the road network, parking areas, timber harvesting, woodlands, savannas, openings, and SPB are taken into account, both short term fluctuations and long term water increases are expected in both stormflow and baseflow.

These increases are more associated with concentrated areas of activity, and more difficult to discern at watershed or landscape scales. The increase in surface storm runoff may cause some localized soil movement, streambank cutting, ephemeral channel scouring, and possibly, stream sedimentation. Increases associated primarily with transpiration reduction may also augment low flows that are so critical for aquatic habitat.

Water Quantity Effects from Activities

As mentioned, compacted road surfaces probably contribute nearly 80-90% of the rainfall as water yield, much of which would be stormflow. These changes are more or less permanent and often increase quickflow rather than baseflow. Compacted surface flow impacts can be mitigated to some extent where frequent cross drainage is used to increase infiltration and reduce channelized flow, erosion, and sediment delivery to streams. Vegetation removal can increase flow up to 40%, returning to original levels over a decade, with vegetation conversion from forest to grassland a lesser, but continuing, effect is likely. Since much of the harvest activity involves thinning or partial harvesting, effects would be much-less-to-negligible on those areas.

Based on local knowledge and field observations, stream channels within the mountains and larger stream channels on the piedmont are usually capable of handling the small increases in flow that are projected for each alternative without causing excessive channel erosion. Small intermittent and ephemeral streams, especially those with entrenched channels with unconsolidated or erosive bank materials, and in severely eroded terrain, can be affected if activities concentrate within these drainages or when BMPs are not fully utilized to limit direct additions of surface flow to headwater streams and gully systems. Short-term increases in water yield during summer low-flow periods associated with most types of timber harvesting is almost always a benefit in downstream aquatic habitats and is also an indicator of higher water tables for increased riparian vegetation and aquatic health along perennial, intermittent, and some ephemeral streams. At project level analyses, high densityof roads, road capture of flow, road surface drainage, timber harvest, conversion of forests to non-forests, restoration, and other activities may need further evaluation for potential water quantity and quality effects on vicinity stream channels. Spacing activities through time and applying BMPs are the best ways to help reduce effects.

Water yield changes can have some direct and indirect effects on resources and water supplies. Currently, water supply vastly exceeds use in most areas of South Carolina. In a few locations, however, use has risen to consume a substantial portion of the supply, especially during low flow or drought conditions. Future water demand is expected to follow population growth.

Water Quantity Effects by Alternative

The indirect effects of the changes in water yield for each alternative were estimated. Baseline water yield for the Sumter National Forest was estimated at approximately 25

inches/year, 2,800 tons/acre/year or 1 billion acre feet as based on several of the stream gaging stations across South Carolina. Average water yield in the mountains is about 40 inches/year, with about 13 inches/year on the Long Cane Ranger District and 19 inches/year on the Enoree Ranger District. Water yield probably averages about 50% of the rainfall amounts, so increases up to 80-90% above existing levels are theoretically possible, assuming some losses for evaporation from surfaces.

To estimate increases in water yield associated with activities, many coarse assumptions had to be made. It was assumed that roads, trails, and other heavily compacted surfaces have a permanent increase in water yield of 60%; temporary roads, a temporary increase of 60% for 10 years; regeneration cuts, a temporary increase in water yield of 30% for 5 years; shelterwood, 15% for 5 years; thinning, 5% for 5 years; woodland conversion, 15% permanent; savanna or wildlife opening conversion, 30% permanent; site preparation by chopping, 5% for 5 years; and low intensity prescribed burning, 5% for 5 years. Activities that reduce water yield include gully and road restoration, -30% for 10 years, fertilization to increase plant cover and vigor on low site lands, -5% for 5 years.

The compiled results that suggest there might be an average annual increase in flow at 2.9% in Alternative G, Alternatives D and I, 4.9%; A, 5.1%; F, 5.4%; B, 5.5%; and E, 6.7%. Increases in flow as a result of the reduction in vegetation and associated transpiration typically are noticed primarily in the summer and fall as a result of higher localized water tables and soil moisture. Water yield is extremely variable in relation to the time of year, intensity and duration of storms, antecedent moisture conditions, as well as the timing of concentration of contributing flows. Water yield increases of less than 10% would probably go undetected. Because these increases are spread over the entire SNF, localized increases related to concentrated actions could be larger than those estimated. These effects should be analyzed on a site-specific basis.

Chattooga River Uses

A substantial amount of detail can be obtained from Amendment 14 of the Sumter Forest Plan. Currently, records show that in normal water years, nearly 100,000 annual floating users are spread along most of the tributaries and the river during some time each year. This situation constitutes a substantial potential and likelihood that there are some direct and indirect contributions associated with compaction, erosion, sedimentation, and fecal coliform problems from these and other recreational uses that concentrate in this watershed.

Wider portions of the floodplain and terraces that are accessible are sought out by river floaters and used for picnics and camping. Except for the river access points that must cross riparian areas, these camping and picnic areas are the most likely to be impacted by river users. Impacts include soil exposure, damage to riparian vegetation from compaction, and sometimes, soil erosion. The effects of these uses can generally be limited in extent and impact through quality design, location, monitoring, and maintenance.

Fecal contamination is a health and public safety issue of concern. Contamination comes from a variety of sources within the watershed. Hansen et. al., (1998) summarize many of the past references and conditions associated with fecal coliform problems of the Chattooga River, specifically Stekoa Creek. Past problems that were identified stem from the waste treatment facility in Clayton, GA, and were also assumed to come from cattle, septic systems, pets, wildlife, and other dispersed potential sources within the watershed, including public camping. Other data from the U.S. Geologic Service from 1997 were evaluated, showing one or more storm periods on most tributaries have fecal contamination problems during storm events. The river uses and associated activities such as swimming and camping are potential contributors to fecal contamination.

Most septic and water treatment facilities used by the majority of the Chattooga human population of 15,400 (1990) are normally very effective at removal of fecal coliform. Failed sewer lines and septic systems can be suspect, but when properly managed and maintained, are unlikely to cause problems. Of special concern are the limited data that suggest that besides the fecal problems in Stekoa Creek and tributaries, the Chattooga River, West Fork, and Warwoman Creek are showing increased signs of fecal contamination during low flow periods, especially when associated with storm events. Whetstone Creek also has fecal contamination problems that have been noted in reference materials. .

In comparison, the river activities may involve only 1,000 people in a day, but the activity involves access and close proximity to the river during the use, suggesting that the river activities may contribute to fecal problems. At this time, the data do not determine the sources of pollution. River uses are suspect along with other potential sources such as livestock, beaver, wildlife, camping, and communities. Streams with cattle access to streams, especially during hot summer days, are likely to be contaminated since cattle reside for extended periods within the channel for water and shade. Also during summer months, there is less flow to dilute the animal wastes discharged into the streams. Storm runoff from other animal, pet, and wildlife uses and industry are suspected as causing some of this problem. Other forest uses including camping, hiking, fishing, etc. that involve people temporarily residing near streams may be other sources.

During non-storm conditions, Chattooga River sections I, II, III and the upper half of IV (i.e., above Stekoa Creek) normally have water quality suitable for swimming. Stekoa Creek exhibits elevated fecal coliform levels even during many non-storm periods. During storms, fecal flushing often exceeds the water quality standard that supports swimming uses on most of the streams. Section I (West Fork Chattooga River) in 1997 has instances where the standard was exceeded by over an order of magnitude (i.e. ten times). Sections of the main stem of the Chattooga River are probably impacted at various times with excessive coliform levels. Stekoa Creek poses some ongoing degree of health risk to river users after it combines with the Chattooga River in the lower half of Section IV. Fecal contamination in Stekoa Creek is sometimes 100 or more times the allowed standards making it impossible for the flow in the Chattooga River to dilute this contamination to acceptable levels. This is the section of the river where swimming

limitations or warnings should be considered until the fecal records suggest the frequency and extent of contamination is greatly reduced.

Chattooga Erosion and Sedimentation

Access and river use exposes and displaces some soil, offering opportunity for causing erosion and sedimentation to occur. Sites that are used for picnics, camping, and/or boat "put-in" and "take-out" points have been identified. Sites on the West Fork are somewhat more deteriorated than those on other sections of the river. Sites along the lower portion of section III and section IV receive the most use. In general, most sites are relatively small in size, stable, and probably contribute some sediment, but nothing substantial. There may be localized aquatic habitats of concern that could be impacted. Periodic monitoring of sites to determine use and conditions is needed in order to implement mitigation measures to correct erosion and sediment problems in a timely manner. Without substantial ongoing monitoring and resource commitments, we are not completely aware of the conditions and are unable to manage, minimize, mitigate, or determine the extent of the effects.

Current regulated river floating use on the Chattooga River, as summarized in Amendment 14, shows a limit of annual self-guided use at 84,600; guided use at 151,400; clinics at 85,200; for a possible total of 321,000 users. Currently; the known use levels are less than 100,000 floaters each year. If river use continues to grow as expected, increased use will cause more effects to fecal coliform levels, soil erosion, sedimentation, compaction at recreational facilities, use of stream banks for transport, etc.

Alternatives A and E that consider increasing river uses above Highway 28 on the Chattooga River will also increase some congestion, compaction, soil exposure, erosion, and sedimentation at access points and similar effects to sites in this section of the river on both areas that are currently under use by campers and others, and also at probably some new sites that are accessible from the river and suit the needs of those that like to float small streams. Most of these effects will probably not be distinguishable from the fishing, camping, sight-seeing, and other effects, except these will probably occur during the high water periods, when some of those activities are reduced.

Cumulative Effects

Stream Sedimentation

To evaluate the alternatives, the 28 watersheds that intersect the Sumter National Forest were utilized to support hydrologic analysis of effects. The size of these watersheds range from 21 to 339 square miles and are USGS 5th level hydrologic units, as modified in a few circumstances. The average watershed size used in this analysis is approximately 160 square miles. The cumulative effects for each alternative were evaluated separately for each watershed, with the significance relative to those effects determined in part by the percentage of watershed within the national forest. Watersheds

with a low percentage of national forest have little or no significance in coarse forestwide or landscape level conditions being addressed (Clingenpeel, 2002, 2003, Hansen and Law, 2002). That does not mean that specific concentrations of National Forest within drainages and tributaries are not important or even critical in individual circumstances (e.g., presence of the Carolina Heelsplitter primarily within the Turkey and Upper Stevens Creek watersheds).

On National Forest System lands, sedimentation is typically the primary factor for ground disturbing activities to consider in reducing water quality. As previously discussed, the sedimentation estimated in this analysis is derived from surface erosion from soil disturbing activities such as roads, timber harvesting, ATV and horse trails, prescribed burning, fire lines and wildlife openings. On private lands, agriculure, pastureland, urbanization, rural development, timber harvest and other activities associated with coarse land use practices are included. A percentage of the erosion from these activities reaches streams and is delivered at the watershed boundary (Swank et. al., 1989). Since watershed sizes and existing sediment levels vary somewhat, sediment by unit area has been included for comparative purposes. Percent changes by watershed are the percent change with respect to the existing condition unless otherwise indicated. The numbers presented are based on many assumptions and information available at the time of this analysis (See process records from Clingenpeel, 2002, 2003). Erosion-based sediment is probably one of the best indicators of soil and water cumulative effects on National Forest System lands. The erosion estimates made in this sediment analysis are based in the Revised Universal Soil Loss Equation with adjustments for localized forest conditions (Dissmeyer and Stump, 1978, Dissmeyer and Foster, 1984, NRCS, 1982, 1989, Hansen and Law, 2002). Sediment delivery is based on Roehl (1962). The ability to estimate sediment for given treatments and conditions has improved through careful analysis and interpretation of available information with GIS and computer analysis capabilities. To evaluate existing and potential watershed conditions for each alternative, the methods consisted of estimating baseline sediment, compiling sediment increases based on existing and estimated land disturbing practices for each land use, determining the percent increase in stream sedimentation and comparing it to watersheds throughout the Southern Appalachian Mountains for each physiographic area. Some assumptions were made on future activities and development to carry out the model for 5 decades to insure the model was producing reasonable long-term results.

Due to natural variability, geography, climatic conditions, and assumptions on which stream sediment values are based, it is important to view these numbers as comparative, rather than absolute values. Stream sedimentation occurs as a result of soil exposure and storm runoff during and following temporary activities for the next several years. Permanent activities or recurrent treatments such as roads produce elevated sediment outputs which may decline somewhat with time as a portion of the exposed surfaces revegetate or stabilize. Roads, trails and wildlife openings produce continued sediment levels in the long term as they continue to be used and are maintained regularly, resulting in the exposure of fresh materials. Road surfacing with aggregate or paving helps to reduce erosion and properly placed surface drainage limits water concentration and

delivery of sediments. Erosion and sediment increases from bare soils are mitigated and stabilized with erosion control methods to help limit effects.

Stream Sediment Effects by Alternative

Existing sediment is estimated at what is occurring today from Forest Service, private, and road activities. Figure 3-3 below displays the estimated existing sediment levels in tons per square mile per year for the Sumter National Forest watersheds.

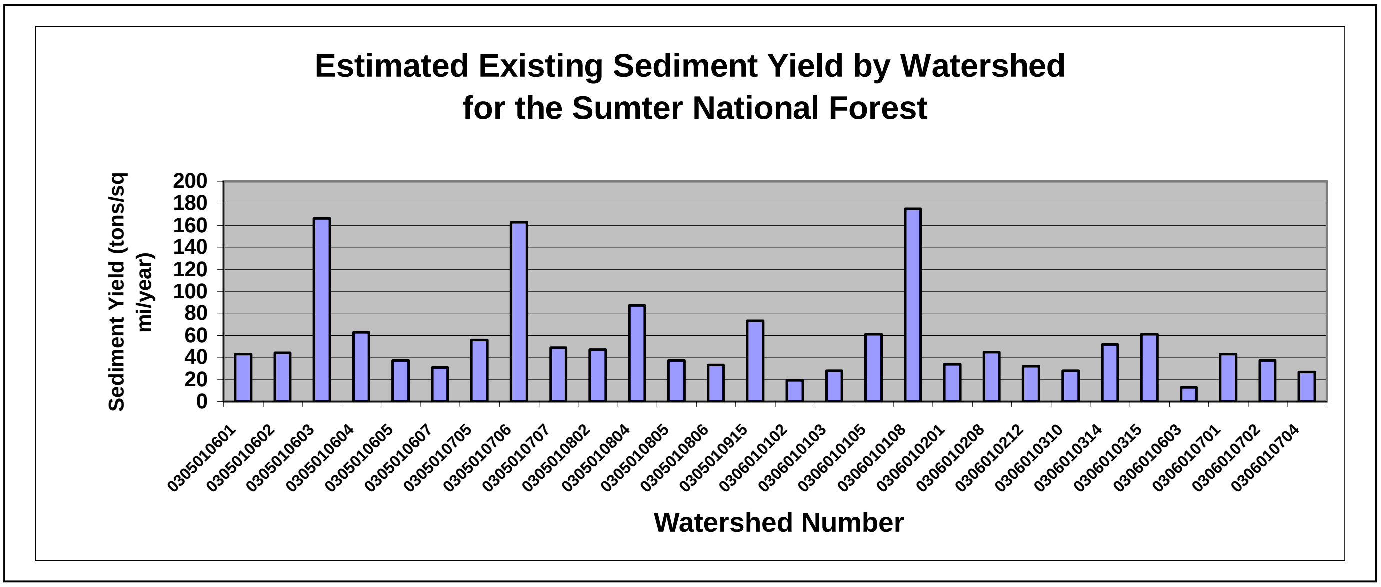


Figure 3-3. Estimated Existing Sediment Yield by Watershed for the Sumter National Forest

Figures 3-4 and 3-5 display a set of seven data points on the bar graph for each watershed. The set of seven points within each watershed are the estimated percent increase in sediment relative to existing sediment levels for the alternatives (A, B, D, E, F, G, I) for period 1. In Figure 3-4, USFS activities from land based activities for each alternative are compared to existing sediment activities. In Figure 3-5, total cumulative activities from Forest Service, private and roads are compared to existing sediment. <u>*Existing sediment*</u> is estimated at what is occurring today from Forest Service, private, and road activities from remote sensing and existing GIS databases on land uses. Forest Service land based sediment values in the model include sediment related to activities, but do not include the temporary roads, permanent system roads and highways that are managed by USFS, state, county, and private landowners. Tables 3-2 and 3-3 are the detailed data associated with Figures 3-4 and 3-5. In tabular form, the values were calculated and carried to two decimal places for convenience, to display the full range in values present, and are not intended to show level of precision or accuracy.

To summarize Figure 3-4 and Table 3-2, the average increase in watershed sediment from USDA-Forest Service land based activities over the existing conditions for the 28

watersheds ranged from the low with Alternative G at 0.7%; Alternatives E and I, 1.3%; Alternatives B, D, and A at 1.5%; and Alternative F, the highest at 1.9%. The maximum increase in sediment from any single watershed from Forest Service land based activities was 15% in Alternative F, with maximums for a single watershed for the other alternatives ranging from 5 to 11% increase. Relative to Forest Service land activities, the Lower Savannah watershed (number 0306010603) consistently had the highest increase in all alternatives except G. Over one-half of the watersheds had increases less than 1%. The percentage increase is based on the existing values as displayed in Figure 3-3. The percentages must be viewed with caution, as a watershed with existing low sediment yield will show a greater increase in percent sediment for a specific sediment increase as compared to one with a high existing sediment yield.

To summarize Figure 3-5 and Table 3-3, the average increase in watershed sediment from the accumulation of all estimated Forest Service, private, and road activities over the existing conditions for the 28 watersheds ranged from the low with Alternative G at 18%, Alternatives A, D, and E at 19%, and Alternatives F, B and I at 20%. The maximum increase in sediment from any single alternative and watershed was 106% in alternative F for the Lower Savannah watershed (0306010603), with the other alternative maximums ranging from 94 to 103% increase. The Lower Savannah has the lowest existing sediment levels of the 28 watersheds, so that explains why these values are so high. As can be seen in Figure 3-5 and Table 3-3, the only other watersheds to exceed a cumulative 30% increase are the Chauga and Whitewater River watersheds. Since the existing sediment levels are relatively low on all the watersheds (Figure 3-3) with high percentage increases in sediment, the magnitude of the increases are to some extent dependent on the existing sediment levels within the watersheds. Percentages are used primarily to help simplify comparisons among the alternatives for each watershed.

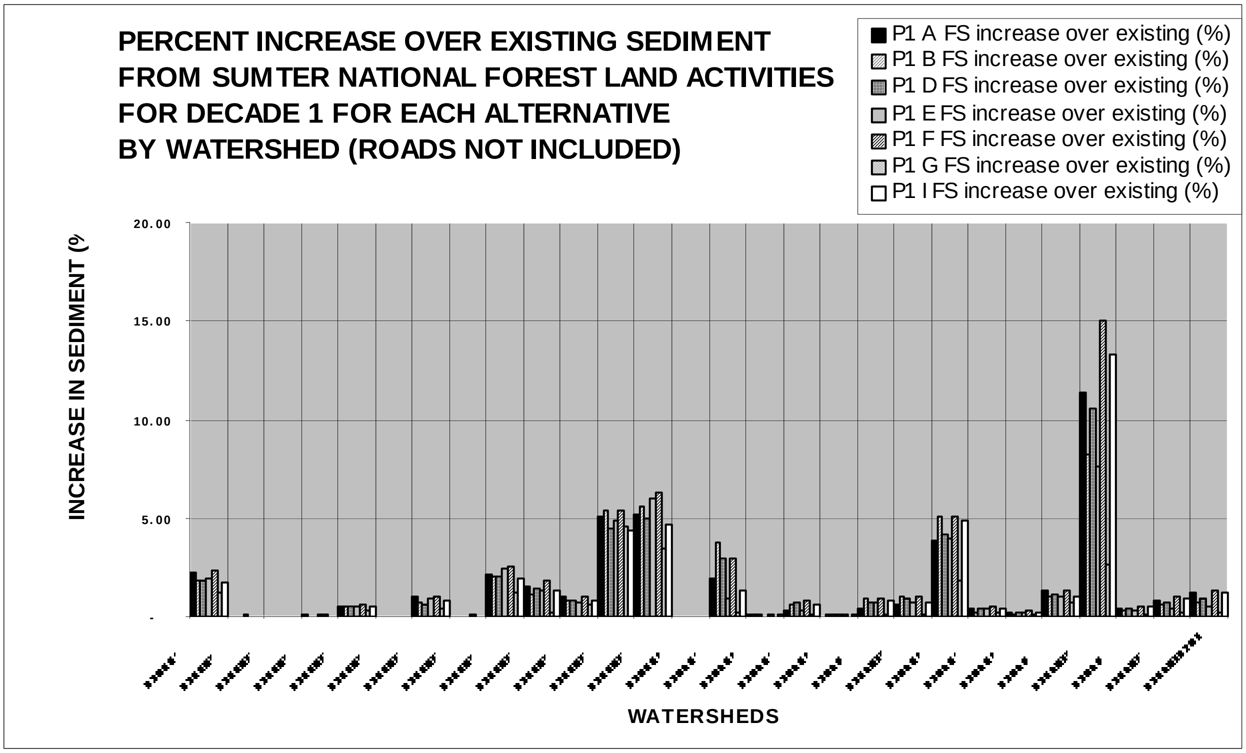


Figure 3-4: Forest Service activities increase in sediment yield by alternative for each watershed in period 1 as expressed as percent change over existing sediment yield.

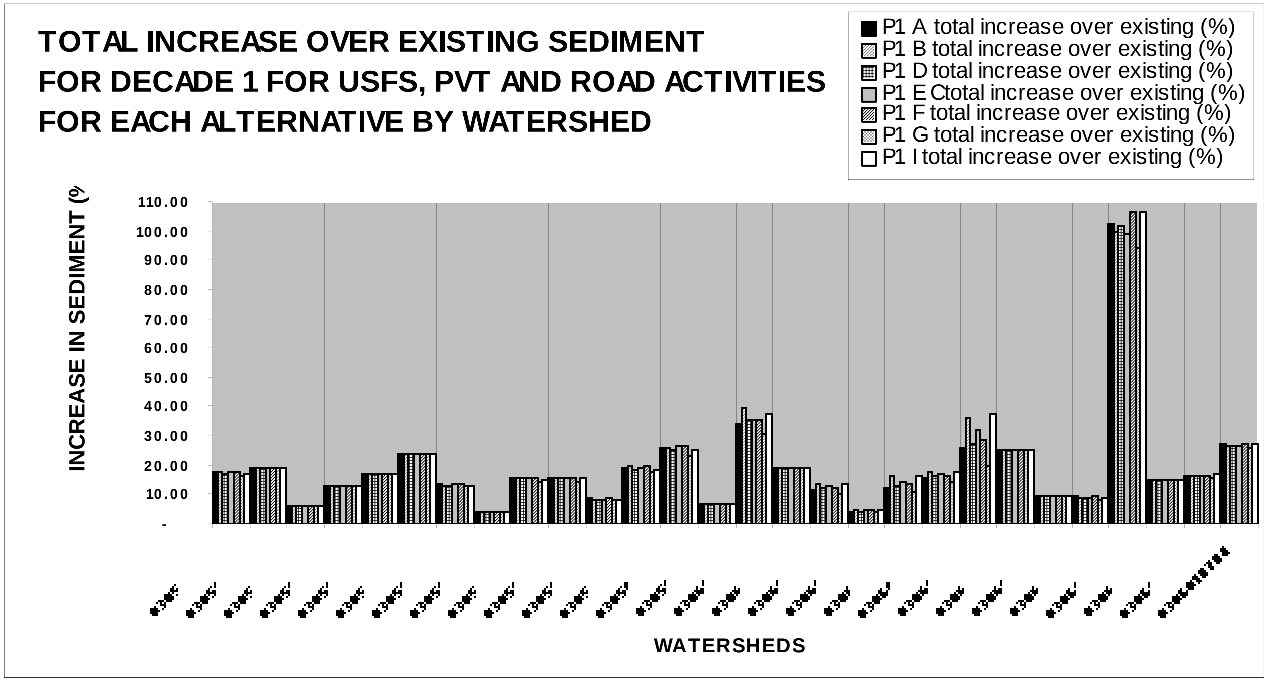


Figure 3-5: Total cumulative activities increase in sediment yield by alternative for each watershed in period 1 as expressed as percent change over existing sediment yield.

In Tables 3-2 and 3-3, columns 3 through 9 display the percentage increases in sediment for decade 1 by alternative and were estimated by the regional sediment modeling tool (Clingenpeel, 2002, 2003) with localized erosion coefficients based on estimated activities with the SPECTRUM model and estimated probable activities on both private and public lands within each watershed (Hansen and Law, 2002).

Table 3-2. Increase in sediment yield by watershed for period 1 from the estimated Forest Service activities as expressed as percent change over existing sediment yield.

Watershed number Watershed Condition Rank (WCR)	Watershed name	P1 A FS increase over existing (%)	P1 B FS increase over existing (%)	P1 D FS increase over existing (%)	P1 E FS increase over existing (%)	P1 F FS increase over existing (%)	P1 G FS increase over existing (%)	P1 I FS increase over existing (%)
0305010601 A	Upper Broad	2.20	1.80	1.85	1.96	2.33	1.26	1.57
0305010602 A	Turkey Creek (Broad)	0.04	0.04	0.04	0.06	0.04	0.03	0.03
0305010603 BA	Browns Creek	0.02	0.02	0.02	0.02	0.02	0.01	0.02
0305010604 A	Sandy Creek	0.05	0.05	0.05	0.06	0.06	0.03	0.04
0305010605 A	Lower Broad River	0.52	0.51	0.49	0.53	0.61	0.34	0.61
0305010607 A	Little River Broad	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0305010705 A	Middle Tyger	1.00	0.73	0.63	0.87	0.98	0.39	0.70
0305010706 BA	Fairforest Creek	0.05	0.03	0.04	0.05	0.06	0.03	0.04
0305010707 A	Lower Tyger River	2.14	2.00	2.03	2.46	2.54	1.17	2.19
0305010802 A	Middle Enoree River	1.54	1.13	1.47	1.31	1.85	0.24	1.33
0305010804 A	Duncan Creek	1.05	0.80	0.85	0.74	1.05	0.61	0.92
0305010805 A	Indian Creek	5.09	5.39	4.43	4.91	5.42	4.52	5.00
0305010806 A	Lower Enoree River	5.19	5.54	4.94	5.95	6.26	3.46	5.89
0305010915 A	Middle Saluda River	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0306010102 A	Whitewater River	1.89	3.73	2.95	0.93	2.92	0.24	1.23
0306010103 A	Upper Keowee	0.12	0.13	0.10	0.04	0.10	0.01	0.10
0306010105 A	Little River Seneca	0.30	0.61	0.69	0.32	0.78	0.09	0.51
0306010108 BA	Coneross Creek	0.05	0.05	0.08	0.06	0.09	0.03	0.08
0306010201 BA	Chattooga River	0.44	0.94	0.75	0.69	0.86	0.11	0.71
0306010208 A	Tugaloo River	0.64	0.98	0.87	0.74	0.98	0.08	0.84
0306010212 A	Chauga River	3.89	5.08	4.18	3.92	5.04	1.85	3.99
0306010310 A	Little Savannah Comp.	0.40	0.24	0.39	0.42	0.48	0.24	0.39
0306010314 A	Little River Sav.	0.25	0.12	0.24	0.25	0.30	0.12	0.28
0306010315 A	Long Cane Creek	1.30	0.97	1.07	1.06	1.34	0.69	1.15
0306010603 E	Lower Savannah	11.32	8.21	10.56	7.59	15.06	2.68	7.76
0306010701 A	Upper Stevens Creek	0.45	0.30	0.38	0.35	0.50	0.10	0.42
0306010702 A	Turkey Creek	0.86	0.59	0.74	0.44	0.99	0.20	0.80
0306010704 A	Lower Stevens Creek	1.20	0.74	0.95	0.53	1.27	0.19	1.02

FS Increase over existing sediment includes only USFS land activities, but no roads

Table 3-3. Increase in sediment yield by watershed for period 1 from the estimated total cumulative activities as expressed as percent change over existing sediment yield.

Watershed number Watershed Condition Rank (WCR)	Watershed name	P1 A total increase over existing (%)	P1 B total increase over existing (%)	P1 D total increase over existing (%)	P1 E Ctotal increase over existing (%)	P1 F total increase over existing (%)	P1 G total increase over existing (%)	P1 I total increase over existing (%)
0305010601 A	Upper Broad	17.64	17.48	17.38	17.64	17.94	16.61	17.25
0305010602 A	Turkey Creek (Broad)	19.15	19.15	19.14	19.17	19.15	19.13	19.14
0305010603 BA	Browns Creek	6.25	6.25	6.24	6.25	6.25	6.24	6.24
0305010604 A	Sandy Creek	12.79	12.79	12.79	12.80	12.80	12.77	12.79
0305010605 A	Lower Broad River	17.17	17.22	17.14	17.23	17.28	16.93	17.14
0305010607 A	Little River Broad	24.18	24.18	24.18	24.18	24.18	24.18	24.18
0305010705 A	Middle Tyger	13.40	13.19	13.02	13.34	13.41	12.70	13.19
0305010706 BA	Fairforest Creek	3.80	3.78	3.79	3.80	3.81	3.77	3.79
0305010707 A	Lower Tyger River	15.55	15.57	15.41	15.99	15.99	14.36	15.32
0305010802 A	Middle Enoree River	15.69	15.40	15.60	15.56	16.04	14.23	15.44
0305010804 A	Duncan Creek	8.59	8.41	8.39	8.33	8.62	8.06	8.38
0305010805 A	Indian Creek	19.10	19.73	18.39	19.17	19.54	18.09	18.37
0305010806 A	Lower Enoree River	25.63	26.26	25.34	26.66	26.80	23.46	25.10
0305010915 A	Middle Saluda River	7.09	7.09	7.09	7.09	7.09	7.08	7.09
0306010102 A	Whitewater River	34.03	39.91	35.56	35.53	35.72	30.89	37.61
0306010103 A	Upper Keowee	19.20	19.46	19.21	19.24	19.21	19.02	19.43
0306010105 A	Little River Seneca	11.41	13.83	12.05	12.66	12.21	10.46	13.80
0306010108 BA	Coneross Creek	4.39	4.56	4.44	4.50	4.46	4.31	4.57
0306010201 BA	Chattooga River	12.47	16.24	13.14	14.62	13.40	10.96	16.10
0306010208 A	Tugaloo River	15.69	17.65	16.12	16.90	16.32	14.45	17.68
0306010212 A	Chauga River	25.92	36.33	27.41	32.25	28.68	20.09	37.48
0306010310 A	Little Savannah Comp.	25.33	25.22	25.33	25.38	25.42	25.13	25.32
0306010314 A	Little River Sav.	9.70	9.60	9.69	9.72	9.76	9.54	9.68
0306010315 A	Long Cane Creek	9.26	9.05	9.02	9.11	9.35	8.52	9.01
0306010603 E	Lower Savannah	102.74	99.63	101.98	99.01	106.48	94.10	106.50
0306010701 A	Upper Stevens Creek	15.17	15.02	15.11	15.08	15.22	14.82	15.36
0306010702 A	Turkey Creek	16.55	16.28	16.43	16.13	16.68	15.89	16.97
0306010704 A	Lower Stevens Creek	27.21	26.75	26.96	26.54	27.28	26.20	27.61

Total Increase over existing sediment includes USFS, Private and all road activities

In general, the watersheds in Tables 3-2 and 3-3 (number in column 1, name in column 2) with the lowest existing sediment levels (Figure 3-3) have the highest percentage change in sediment (columns 3-9). The reverse is also true as those watersheds with highest existing sediments have the lowest percentage increases. So the values presented are most meaningful in comparing relative differences among the alternatives, so care should be used when applying the percentage increase values to compare differences between or among watersheds. Abbreviations used include: P1 is the first decade while A, B, D, E, F, G and I are the alternatives under consideration for plan revision. Only very minor changes were noted over the other four decades from the values presented in this table, so they are not presented in detail, but are available in the process records. The first 14 watersheds, 030501xxxx, have portions associated with the Enoree Ranger District. The next seven watersheds, with beginning numbers 03060101xx and 03060102xx, are associated with the Andrew Pickens Ranger District. The final seven watersheds,

beginning with 03060103xx, 0306010603 and 03060107xx, are linked to the Long Cane Ranger District.

Erosion-based sediment values do not include stream channel, gully, or mass movement types of erosion. In addition, legacy sediment sources based on historic conditions are not addressed. Substantial variability of watershed conditions exists among the watersheds, based on compiling information on a variety of activities, water quality, and biological factors at landscape or watershed scales (Holcomb et. al., 1999, Hansen et. al., 1999, 2001, Clingenpeel, 2002, 2003, Scott et. al., 2003). The piedmont watersheds with greater frequency of roads, more agriculture, silviculture, rural and urban development, tend to show substantial increases over baseline conditions as compared to mountain watersheds that typically have higher percentages in forests, with fewer roads and less development and agriculture.

Calculations suggest that watersheds with significant national forest ownership (over 17%) are within the average to excellent conditions when compared to the other watersheds in that physiographic area (Clingenpeel, 2002). As mentioned elsewhere, only the Upper Broad, Lower Tyger, Middle Enoree, Duncan Creek, Indian Creek, Lower Enoree, Chauga, Long Cane Creek, and Lower Savannah watersheds had over 17% of ownership within the Sumter National Forest and this level of ownership may have some potential to affect water quality and/or aquatic health (Clingenpeel et. al., 2002). The poorest or below average watersheds are those where Sumter National Forest management has ownership of less than 17%, and higher non-forest land uses such as agriculture, urban areas, and developments exist. The detailed calculations and assumptions by Clingenpeel (2002, 2003) associated with the regional sediment model, and Hansen and Law (2002), relative to localized erosion information for the Sumter National Forest, are available in the process records.

In a separate analysis, an estimate of watershed condition rank (WCR) was compiled by Clingenpeel et. al. (2003, Scott et. al., 2003). This analysis evaluated the sediment percent increase over baseline in comparison with other watersheds within the physiographic area, and categorized them into three groups, below average, average and above average. Of the twenty-eight watersheds, nine had 17% or more ownership on the Sumter National Forest, of which one rated excellent and eight rated average. The Chattooga Watershed (WS# 0306010201) does have substantial National Forest land if you consider Georgia and North Carolina. It rated below average in the WCR list using the localized erosion coefficients from South Carolina. However, the normalized sediment comparison of the 28 watersheds indicates that the Chattooga is estimated to produce relatively low sediment loading per unit area. More discussion relative to aquatic habitat effects relative concerning the WCR analysis is provided in the section on Watersheds and Aquatic Habitats. During the five decades under analysis, none of the alternatives change their watershed condition rank category in any of the alternatives based on sedimentation from projected land use practices.

Three other watersheds, Coneross, Fairforest and Browns Creek had substantial changes from estimated baseline conditions within their physiographic areas and were identified

as below average watersheds (Clingenpeel et. al., 2002, 2003). They are can be noted easily in Figure 3-3 with normalized sediment values exceeding 160 tons/square mile/year. The Sumter National Forest makes up only a small portion of each of these watersheds, so the increases associated with national forest management are not expected to be significant. The below-average watersheds contain the largest cumulative increases in stream sedimentation based on activities over natural conditions. However, their percentage increase over existing in the alternatives tends to be among the lowest increases. This is due to the high existing levels that are used in comparison. Based on the land use practices and sediment model results, these high sediment values are primarily on private lands from land use practices, not just roads. Significant urban, agriculture, or other types of concentrated and dispersed ground disturbing activities make the difference. Regardless of the alternative, most Forest Service activities tend to generate relatively minor effects. In addition, the effects of most vegetation management are temporary and infrequent, except for roads, trails, and special wildlife enhancements. Best management practices, which are consistently applied on the national forests, may further reduce these estimates to only a fraction of these amounts. The effectiveness of BMPs at reducing erosion and sediment are not well quantified, but in visual field checks and applying biological surrogates, they appear effective (Adams and Hook, 1993). In addition to the BMPs, the measures utilized in the riparian corridors and channeled ephemeral streams may provide even more reduction to erosion reaching stream systems. The reductions in sediment production from Alternative F would not have the full benefit of the riparian corridor. In Alternative F, the lands within the riparian areas are part of the suitable land base and still subject to BMPs and other measures to control the impacts of activities, especially sediment production. When appropriate, a subwatershed or drainage analysis would be used at the project level to assess cumulative impacts over more localized conditions.

The cumulative effects of mining and mineral development will not be much different between alternatives. The effects to soil and water resources do not depend very much on the acres that are available for development, because most of the acres available have little likelihood of mining or mineral concentrations. In addition, stringent standards to prospecting and mining activities will be applied to avoid or minimize surface occupancy and any direct or indirect discharges to streams and aquatic habitats. Private minerals will be administered the same in all alternatives. Some current recreational mining activities in the mountains will be given more scrutiny to insure that the permittees are sampling stream gravels, avoiding streambanks and native surfaces, and limiting water quality and aquatic habitat impacts. Alternative G will have the least federal mineral development and the cumulative stream sediment levels and water quality should be better than current conditions. Alternatives A, B, D, E, F, and I will involve slightly higher development potential but sufficient direction and standards exist to consider and protect water resources.

Sediment-producing factors not reflected in the stream sedimentation values in Table 3-2 are the impacts of undesignated OHV, ATV, and horse trails (officially designated trails were included), impacts of many private and public arterial roads, individual home developments, gullies, channel erosion, mass soil movements, and other fine features that

are not differentiated in landscape level analysis of land uses with remote sensing techniques. The lengths of ATV trails and arterial roads vary widely between watersheds and through time. Over the last five years numerous miles of arterial roads and ATV and OHV trails have been closed on National Forest System land. However, during this time frame, the miles of undesignated trails have increased substantially on the piedmont districts. Acquisition of mountain land with existing roads and trails that are in poor condition, that need reconstruction to forest standards or closure, is another concern. Based on field observations, undesignated trails primarily exist on national forest lands in proximity to existing trail systems and also sometimes are associated with other management activities such as skid trails, temporary roads, fire lines, and relatively open adjacent areas, regardless of the alternatives. These unauthorized trail mileage estimates vary widely, making it unrealistic to include them in the sediment model. Data for many of the arterial and private roads were also not available. Nonetheless, the data used and calculations made for this scale of analysis should indicate the major trends and differences among the alternatives and watersheds, and be meaningful for planning level comparisons and analyses.

Water Yield

Hydrologic impacts generally do not occur if less than 25% of the basal area (BA) is removed (Douglas and Swank, 1972). Recovery after forest harvests that exceed 25% removal of the BA is rapid and generally complete within 5 to 15 years (Hornbeck et. al., 1995; Swank et. al., 2001; Verry, 1988). These types of impacts are generally going to show up at the headwater, small drainage scales, where activities concentrate, in areas of extremely erosive channel materials andwithin watersheds with extensive modifications and development. Generally, flow dynamics are much less complicated in headwater streams. In stable terrain, channels may be more able to adjust to small or moderate, temporary increases in flow. However in headwater areas where activities concentrate, increases in flow may occur from vegetation change, road surfaces runoff, stream capture and/or diversion of stormwater onto slopes or into stream channels not used to the excess flow. Swank et. al., 1988 summarized that vegetation cutting alone without removal increased peakflow about 7 percent due primarily change in leaf surface area (evapotranspiration). They found that clearcutting about one half of a headwater drainage with relative high road density and tractor skidding increased peakflow 30 percent. Clearcutting with cable logging and low road density increased peakflow 15 percent. Conditions that focus excess flow into small streams may cause channel overload, adjustments, and water quality impacts. This is especially a critical consideration in gullied, unstable terrain or in entrenched channels in unconsolidated, fine materials. The actual specifics relative to when channel adjustment will or will not occur due to changes in flow are not well studied. Small or temporary increases in flow into stable channels with vegetated streambanks will have low risk for impacts. Extended or permanent flow changes are likely to produce some channel adjustment, and the environmental risk associated with those adjustments will vary with the circumstances. As indicated, many of the streamtypes in the mountains and piedmont are entrenched, and do not have access to a normal floodplain that reduces stress on the channel banks during flood events. In entrenched channels, floods put added stress onto the

streambanks and channel. Channels in unconsolidated materials adjust under these circumstances. The adjustments typically involve channel degradation and/or widening, streambank undercutting and failure, adjacent trees leaning with rotating rootwads, eventually causing bank slumping and/or trees falling into the stream. Bank caving and failure and coarse woody debris entry produce added stress on the adjacent channel as portions of the channel are blocked, restricting and deflecting flow with stress added on other areas. The processes are natural, but may be unduly accelerated when water yield changes exceed the normal range and frequency of flow on sensitive streams.

Swank et. al., 1988 indicated that conversion from hardwoods to white pine produced a 20% reduction in flow by year 10, with some possible further reductions in some years reaching 40-50% by year 25 as white pine matures. Thinning of pine generally increased flow to hardwood levels, to decline back to the 20% reduction again by year 10. They also indicated that grassed lands produced 10-15% more flow, which was reduced to no difference from hardwoods in years when the grasses were fertilized and productivity increased. Areas where the grasses were deadened with herbicide treatments produced about a 25% flow increase as compared to hardwood stands.

Water yield increases at landscape or watershed scales become much more complex from the variety of activities that may occur. Developments such as roads, parking, houses, buildings, and altered vegetation can increase impervious surfaces, modify the ability of the water to infiltrate and move in the soil, and/or change the evapotranspiration values that affect the hydrologic cycle and water yield. Since water yields are typically about one-half of the rainfall rate, impervious surfaces may be able to increase flow up to about 100 percent. Some of the larger developments use storm-water retention ponds or other structures to detain, retain and reduce the storm-water effects from large paved or developed areas. Frequent road drainage into forested or vegetated filter strips helps to reduce impervious road surface impacts to streamflow. Ponds and reservoirs also change water cycling and yields, reducing transpiration but increasing evaporation.

Substantial water yield decreases can also impact channels by reducing the frequency and extent of flooding, allowing channels to encroach with vegetation, diminishing their capacity and reducing the ability to transport sediments, causing channels to aggrade. Declining flows can also impact aquatic habitats directly by reducing the active channel area and altering habitats as channels aggrade with sediments. The extent of the changes depends on the specific circumstances and are likely to be more severe where activities are concentrated in time and space within a specific hydrologic unit.

Water Increase Effects by Alternative

At landscape or watershed scales, average water yield increases for each of the alternatives from Forest Service activities ranged from 3-7% within the national forest as discussed in the direct and indirect effects section. These effects may be of concern where activities concentrate, producing water yield increases several to many times higher into local drainages. Certainly at cumulative scales, there are a variety of activities and conditions that can influence water yield from exposed or impervious

surfaces, such as farming and urban development. However, these increases may be moderated by surface drainage features such as floodplains that adsorb and reduce the direct effects from storm-flow increases, and by small ponds and reservoirs that capture and retain surface flow. In some instances, grasslands and agricultural areas on private lands are being converted to forest uses, and these types of changes may cause some water yield decline, as trees utilize more water in transpiration processes.

Evapotranspiration from pine trees is higher than hardwood trees and there is some attention in all alternatives to increasing hardwoods or obtaining mixed stands. On much of the private lands, pine is the tree of choice for commercial forest lands, while hardwoods are desired by many rural landowners for their beauty, longevity, and wind firmness. Much of water yield increases due to vegetation cutting or conversion to grasses occur primarily in the spring and summer months when the trees would have been transpiring water. Water supply typically exceeds demand in most years within South Carolina, so the increases during the baseflow season may go unnoticed, but will generally augment local water users, instream uses, and aquatic habitats. In infrequent periods dominated by extended droughts, more attention may be given to elements within the hydrologic cycle with attempts to manage water quantity.

Water yield increases can influence water uses, and vice-versa. The potential impact of water uses is also not well documented in states with riparian rights such as South Carolina. Major water uses are known or estimated, but small uses are probably not quantified or known. Table 3-4 indicates the water withdrawals of record compiled by the South Carolina Department of Health and Environmental Control for the subbasins of interest to the Sumter National Forest. Water withdrawals and uses can impact water yields to downstream areas. Connections between the potential increases in flow from forest management and private land activities to most of the other water withdrawals would be speculation.

So as suggested, the cumulative effects to water yield are complicated by land management activities, the types and amounts of vegetation present, impervious surfaces, consumptive water uses that have been developed and nonconsumptive needs that may not be well documented, but are no less important. Effects on water yield are normally not a significant issue relative to Forest Service management activities in the southeast. Rainfall distribution and water yields are normally ample to accommodate many uses and conditions. The effects of land management under most scenarios are minor to moderate. These types of cumulative effects would be best addressed for specific conditions and circumstances where watershed management activities or developments that influence water yield are substantial, such as affecting the vegetative cover in the short term over 25% of an area or when altering normal hydrologic processes such as building dams, consuming water, substantially disturbing the soil surface or expanding the extent of roads, parking areas and other impervious surfaces within an area.

Water Uses

Consumptive uses of water are those that divert or remove water from the stream channels or lakes, with little return. A variety of consumptive uses may be present and include administrative uses, drinking water, fire suppression, irrigation, and other needs. Non-consumptive uses of water include instream flows for aquatic organisms, to maintain channel capacity and provide pleasing visual conditions at waterfalls or for streamside camping. Aquatic organisms can be affected by flow changes, especially those that alter or restrict the access to and emerging from spawning gravels, restrictions in water available for channel substrate flow, and those that reduce baseflow or minimum streamflows to the extent that water quality and habitat space produce limiting characteristics. There is increased evidence that normal hydrologic cycles benefit both physical and biological processes. Restricting or substantially altering these normal processes can produce impacts. Increases in baseflow are normally desired as beneficial to aquatic life. Increases in quickflow and storm-flow are usually not considered as beneficial in that they are apt to cause impacts by increasing erosion, sediment, pollutants, channel scour, flooding, etc.

Table 3-4. Total major water uses by subbasin (8 digit HUCs) compiled by the SC Department of Health and Environmental Control. Most of these uses are not associated with the Sumter National Forest.

Water Withdrawals by categories for 8 digit HUCs - South Carolina, 1995

		Water withdrawals (Mgal/d)									
HUC - 8		Public Supply	Commercial	Domestic	Industrial	Thermoelectric	Mining	Livestock	Aquaculture	Irrigation	Total
03050106	Lower Broad	1.33	0.27	6.65	2.32	858.25	0.00	0.27	0.03	0.02	869.14
03050107	Tyger	30.26	0.00	4.96	2.90	0.00	0.00	0.16	0.03	0.00	38.31
03050108	Enoree	3.53	0.14	5.02	122.78	0.00	0.00	0.24	0.02	0.12	131.85
03050109	Saluda	82.32	0.15	0.50	29.52	187.32	0.00	1.65	0.09	1.40	302.95
03060101	Seneca	14.48	0.00	3.45	1.77	2,523.51	0.00	0.27	3.54	0.12	2,547.14
03060102	Tugaloo	1.41	0.00	1.55	0.00	0.00	0.00	0.08	0.01	0.13	3.18
03060103	Upper Savannah	16.38	0.00	1.46	0.54	0.00	0.00	0.35	0.53	0.00	19.26
03060106	Middle Savannah	28.96	0.07	2.57	120.86	162.92	0.00	0.42	0.05	1.62	317.47
03060107	Stevens	1.96	0.20	0.53	0.03	0.00	0.00	0.26	0.02	0.01	3.01
Total:		180.63	0.83	26.69	280.72	3,732.00	0.00	3.70	4.32	3.42	4,232.31

A variety of methods exist to help evaluate water needs and determine the acceptable limits of water use, based on instream flow protection strategies and methodologies (USFS, 2000, IFC, 2002). Not only do humans need water to properly function, but streams, aquatic and riparian organisms also need water to maintain their function. The quantity and timing of this need varies with the conditions and the resources involved. Without identifying the needs, evaluating the uses and quantifying the needs, unnecessary impacts may occur to those species and uses that depend on sufficient water being there when it is needed.

Chattooga River Uses

Sediment sources include agriculture, development, roads, silviculture, and wildlife activities. From past water sampling and flow records by USGS, State of Georgia, EPA, and USDA Forest Service, Stekoa Creek produces over one-half of sediment and fecal

loading within the Chattooga watershed. Total maximum daily loads (TMDL) for sediment have been set by the EPA for sections of Stekoa Creek, Warwoman Creek, and West Fork Chattooga River (EPA, 2001).

The fecal coliform levels within the Chattooga River and tributaries found during storm events are often high enough to be of concern to swimmers and for other water contact sports that are often present when floating the river. This is especially true of storms that are intense or that follow dry periods. The water quality in Stekoa Creek suggests that even non-storm periods may intermittently or perhaps even regularly contaminate the lower portion of the Chattooga River with elevated fecal materials that are of concern for swimming and related water contact uses.

Other USGS information collected in 1997 provides more intensive fecal coliform sampling within the Chattooga River and major tributaries. Unfortunately, only a few samples collected were associated with storms. Individual samples were taken in the Chattooga River at Highway 76, Stekoa Creek, Warwoman Creek, West Fork Chattooga River, and North Fork Chattooga River. Maximum values reported for these streams included 490; 54,000; 7,900; 3,300; and 230 MPN fecal coliform/100 ml, respectively. Except for the North Fork of the Chattooga River, all major tributaries were at least an order of magnitude greater than the allowed water quality standard for swimming that is set at 200 MPN/100 ml. All of the above readings except for the North Fork locations were taken during the June 12, 1997, storm under moderate flow conditions. During that day, the measured flow at the Highway 76 stream gaging station was 929 cubic feet per second (cfs). From the past data records, elevated storm values in some of the tributaries are not uncommon, suggesting that there is a problem.

Sediment is a concern within the Chattooga watershed because of its effects to water quality, aquatic life, and recreational uses of the river. Erosion and sediment levels are naturally high, to some extent due to the high rainfall, well-weathered soils, and steep and dissected slopes. The Chattooga River has high sediment levels as a result of roads, developments, agriculture, and other land disturbing activities (Van Lear et. al., 1995).

Riparian, Wetlands, and Floodplains

Affected Environment

The Riparian Corridor is management prescription 11 in the Draft Sumter National Forest Plan, which includes true riparian areas and a fixed width area along perennial and intermittent streams and waters for management purposes, unless specifically evaluated and determined to need more or less. In some instances, the boundary may fall beyond the true riparian area and include an upland component. This prescription was designed to address a combination of water quality and habitat concerns associated with streams, streambanks, riparian areas, and wetlands. An estimated 60,000 to 70,000 acres are within the riparian corridor on the Sumter National Forest, based on the extent of alluvial soils, bottomland hardwoods, floodplains, mesic river terraces, estimating perennial streams to the extent of order 3 and larger streams, and intermittent streams to the extent

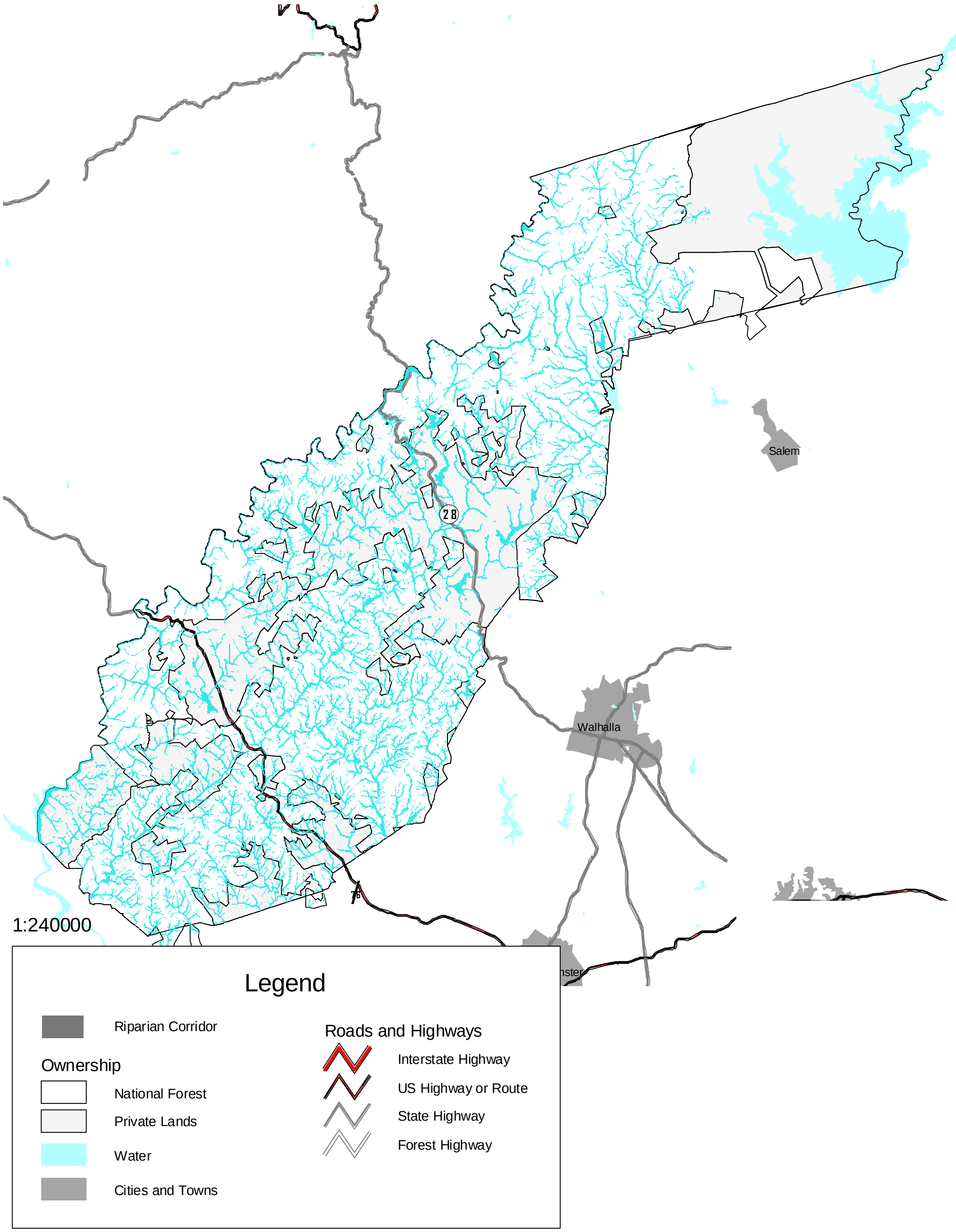
of order 2 streams. Due to its complexity and interconnections with much of the stream channel network, maps are difficult to display at small scales typically used in forest planning. The extent has been estimated and mapped in GIS and included in the process records and will be utilized in watershed analysis and verified for project planning.

Riparian areas are functionally defined as three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems, that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width (Ilhardt et. al., 2000). These areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological process, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams and lakes and estuarine-marine shorelines. (National Research Council, 2002.)

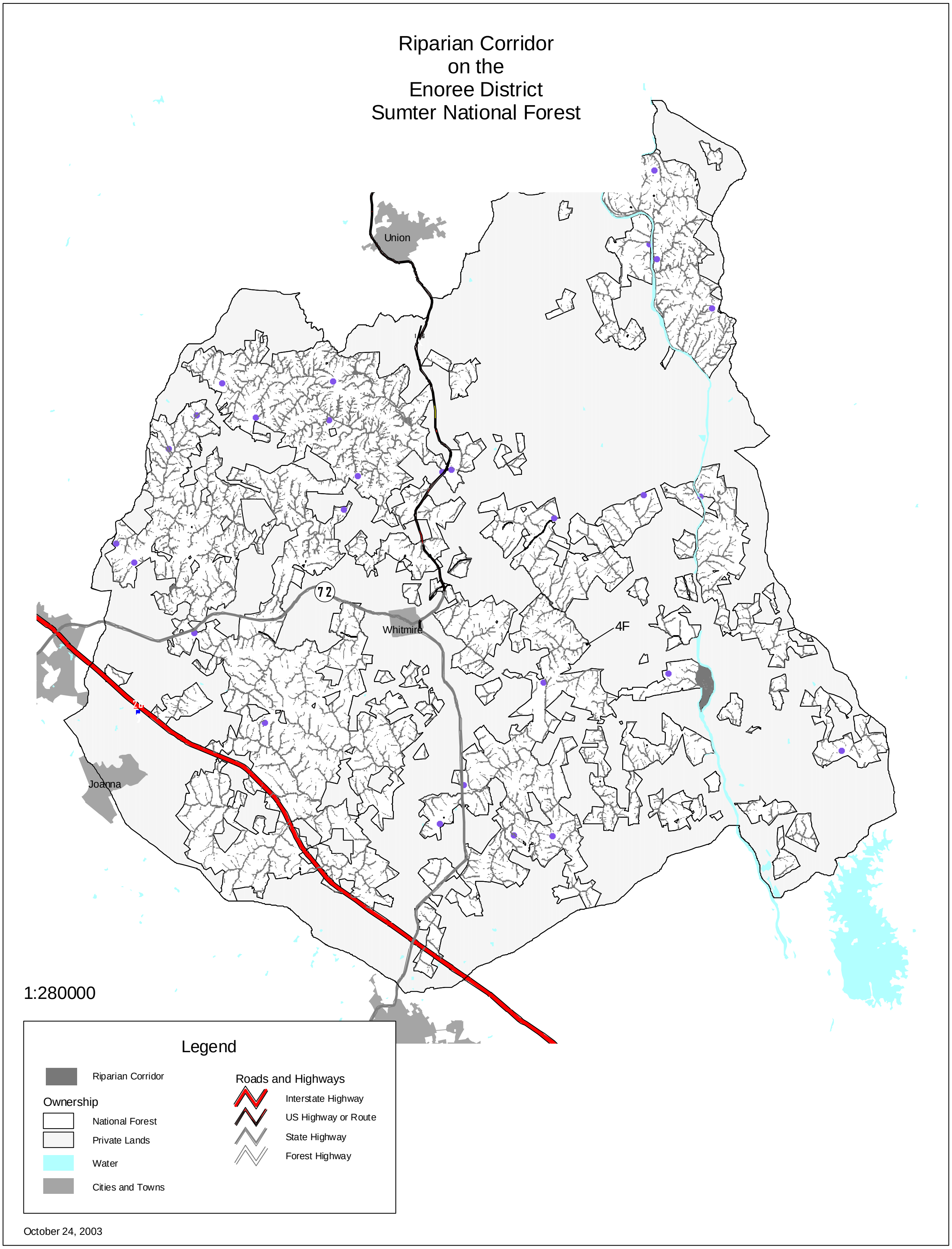
Floodplains are lowland or relatively flat areas joining inland and coastal water including, at a minimum, that area subject to a 1-percent (100-year return period) or greater chance of flooding in any given year. Although floodplains and wetlands fall within the riparian area criteria, they are defined here separately as described in the Forest Service Manual. Responsibilities in floodplain areas include recognizing the functions and hazards within these areas and making sure that the public is aware of them, especially as related to forest management activities or facilities (Executive Order 11988, FSM 2527).

Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40CFR232.2) and are found within some of the riverine and lacustrine systems on the Sumter National Forest. Protection of wetlands on federally managed lands is addressed in Executive Order 11990 (FSM 2527).

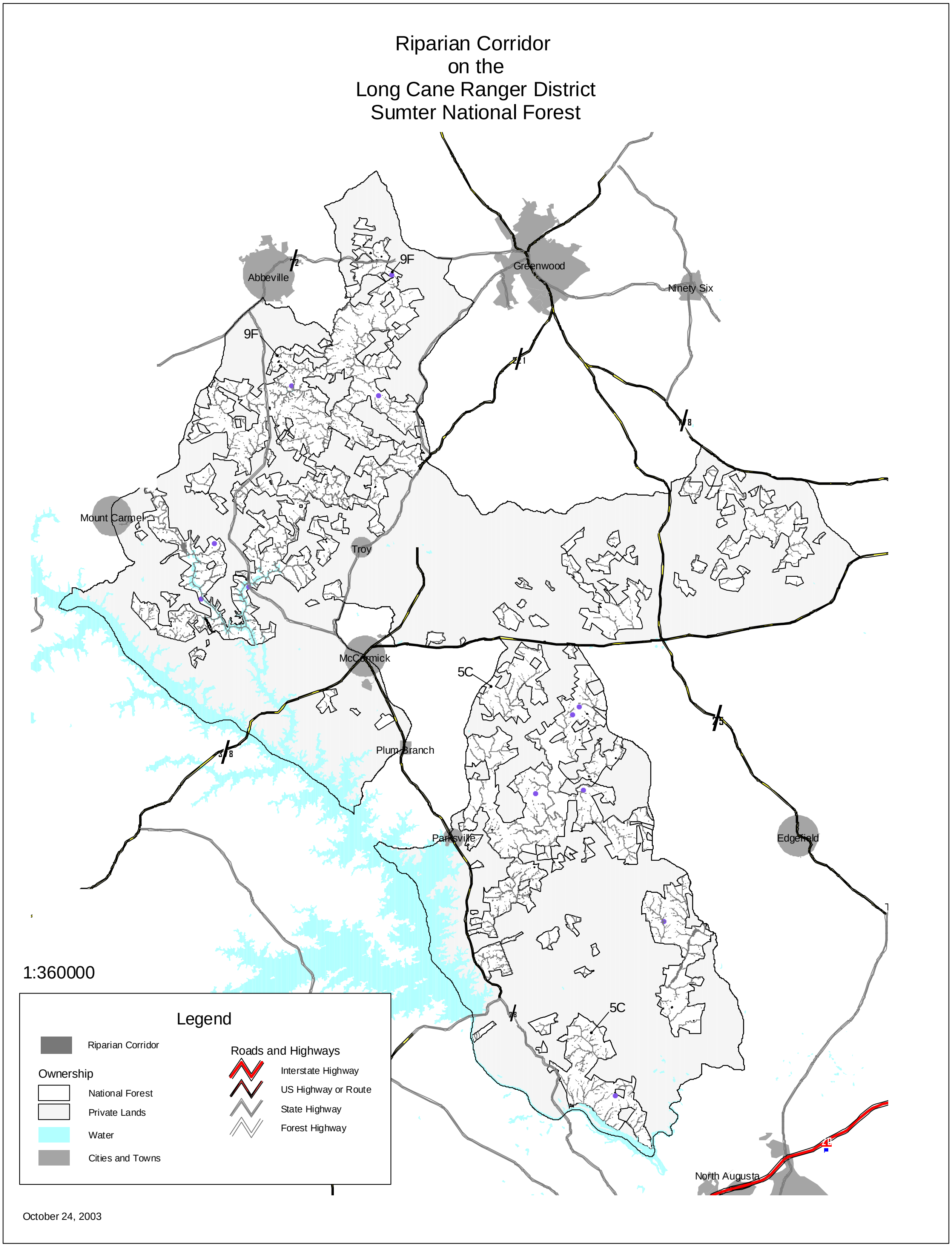
Riparian Corridor
on the
Andrew Pickens Ranger District
Sumter National Forest



October 24, 2003



Riparian Corridor
on the
Enoree District
Sumter National Forest
Union
Whitmire
Joanna
72
4F
1:280000
Legend
Riparian Corridor
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 24, 2003


Riparian Corridor
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
Greenwood
Ninety Six
9F
Mount Carmel
Troy
McCormick
5C
Plum Branch
Parksville
Edgefield
North Augusta
1:360000
Legend
Riparian Corridor
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 24, 2003

Wetlands on the Sumter National Forest are widely dispersed and usually are small inclusions of less than 10 acres. Jurisdictional wetlands must meet soil, plant, and hydrology criteria (Environmental Laboratory, 1987). Riparian areas may contain some of the conditions and functions of wetlands, and their extent can be estimated from the alluvial soils within soil survey maps. Wetlands typically have not been identified specifically on the Continuous Inventory of Stand Conditions (CISC). The bottomland hardwood stands typically qualify as riparian areas, but because many of these soils are well drained, only a small portion would qualify as meeting the soil, plant, and hydrology requirements of jurisdictional wetlands. Small-scale wetland mapping by U.S. Fish and Wildlife is underway and will provide remote mapping information on their approximate extent. However, many of these areas need to be field verified for accuracy and are when activities may damage, destroy or convert wetlands to non-wetlands.

When wetlands exist in the piedmont and mountains, they are usually found within the floodplain of streams or occasionally on shallow soils with a clay pan, fragipan, or geologic substrate that restricts water movement through the profile. Wetland soils are hydric and typically exhibit a variety of indicators. Most wetland soils are gleyed or mottled heavily with organic accumulations due to anaerobic conditions, except where the organics are removed during floods. Soils remain saturated into the growing season with predominately wetland adapted tree and plant species present, such as bottomland hardwoods. Wetland hydrology typically is based on one or more of a combination of factors including stream flooding, high groundwater table, and soil restriction with storage of rainfall or groundwater.

Most floodplains have well drained sandy soils, so the soils typically are not saturated long enough from stream flooding to meet the necessary hydric soil criteria for jurisdictional wetlands. However, these riparian areas often do provide some wetland-type functions and habitats. The identification and delineation of wetlands is typically a project level activity, as these areas are usually too localized in extent to show up with reliability in the inventory and mapping data (Environmental Laboratory, 1987).

In 1985, it was estimated that the Sumter National Forest contains approximately 13,400 acres of riparian areas based on alluvial soil mapping units that include floodplains and adjacent depositional terraces on the Sumter National Forest (Hansen and Law, 1993). Of this amount, approximately 1,500 acres are wetlands. Alternative F would hold to these estimates, and all of the riparian lands are suitable for timber production. Best management practices, including streamside management zones, would still be implemented. Alternatives A, B, D, E and G allocate 67,000 acres of land into riparian corridors, which includes streams, riparian areas, floodplains, wetlands, and some adjacent uplands along most perennial and intermittent streams with limited floodplains and terraces. Alternative I allocates approximately 63,000 acres into the riparian corridor. Another 3,300 acres of water (primarily lakes and wide streams) are also present within the national forest. In comparison to the piedmont, the mountain valleys limit the extent of riparian areas, floodplains, and wetlands because they are much more confined with higher gradients and topographic or geologic barriers.

Direct/Indirect Effects

Roads, trails, and other compacted or exposed surfaces often create problems when located in riparian areas because they tend to entrench, are difficult to drain, cause excessive compaction or displacement of soils, alter normal surface and subsurface flows, and increase pollution to streams.

Riparian and stream areas are often a desired focal point associated with many recreational activities. People just love the sights, sounds, life and movement associated with streams and riparian habitats. However, riparian areas and streams are often very sensitive from a physical and biological sense to many activities that people enjoy. Activities involving concentrated people or animal uses, heavy equipment, or horses can cause excessive soil compaction or exposure. Indirect effects from these include restricted drainage, surface runoff, and/or excessive holding of water on the surface. Damage to tree and plant roots from compaction can reduce health and increase mortality. Increased erosion, sediment, and stream temperatures can be a result of concentrated recreational uses.

Developments in riparian areas such as water bird habitats and green-tree reservoirs may cause modifications of hydrology and soil conditions, benefiting some types of habitat and impacting others such as aquatic migration. Some of these effects can be minimized or mitigated. Cane restoration and associated group selection harvesting and frequent prescribed burning in riparian areas may involve some new approaches to improve vegetative and biotic habitat conditions without damaging soil and water resources. Riparian timber harvesting can be problematic due to poor access and difficulty in getting equipment to the treatment areas. Restrictions on soil moisture and proximity to streams may limit these projects to suitable river terrace areas.

Emphasis is given in management prescription number 11 for all alternatives except F to protect and improve floodplains, wetlands and riparian areas, as well as reducing impacts to species at risk. Alternative F would still utilize laws, executive orders, planning regulations, BMPs and other protective measures in riparian areas to avoid many impacts. Probable activities suggest that Alternatives B and E would stress riparian harvest and forest health; Alternatives A, E, and I, trail construction; Alternatives F, E, D, A, and I, wildlife openings; Alternatives G, B, and I, canebrake restoration; and E, B, F, and I, water bird developments that would likely influence the riparian corridor directly or indirectly. Alternative B emphasizes soil and water restoration, some of which may occur along unstable streambanks.

Cumulative Effects

Roads, trails, and other compacted or exposed surfaces on the national forest and private lands often create problems when located in riparian areas because they are difficult to drain, cause excessive compaction or displacement of soils, alter normal surface and subsurface flows, and increase pollution to streams. Activities that remove trees and other supporting vegetation from streambanks and adjacent riparian areas, or otherwise

promote other uses in riparian areas, often increase stream temperatures, streambank instability, channel adjustments, and loss of riparian and aquatic habitats. Some partial vegetation harvest can be beneficial to tree health as long as removal activities do not excessively compact, rut, or expose riparian soils.

Riparian and stream areas are a desired focal point with many recreational activities. However, riparian areas and streams are often very sensitive from a physical and biological sense to many activities that people enjoy. Concentrated people or animal uses, heavy equipment, or horses can cause excessive soil compaction or exposure. OHV/ATV trails have high impacts in riparian areas from soil disturbance, compaction, displacement, rutting, productivity loss, erosion, sediment, streambank damage, and channel damages. Conversion, expansion, or maintenance of wildlife openings into these areas need to focus on continuing cover, maintaining stream shade and bank stability with forest vegetation. Indirect effects from these include restricted drainage, surface runoff, and/or excessive holding of water on the surface from activities that compact or rut the soil surface. Damage to tree and plant roots from compaction can reduce health and increase mortality. Increased erosion, sediment, and stream temperatures can be a result of concentrated recreational uses. Besides native forests that provide shade, deep roots, woody debris and other benefits in the riparian areas, the resilient native plant species, adapted to moderate to high moisture regimes are also beneficial. Some attention to removal of non-native invasive species may be needed in some locations, necessitating local applications of herbicides or other methods for control. Most effects associated with activities and treatments in riparian areas need special attention so they can be avoided, minimized or mitigated.

Emphasis is given in management prescription number 11 for all alternatives except F to protect and improve floodplains, wetlands, and riparian areas, as well as reduce impacts to species at risk. Alternative F would still utilize BMPs and other protective measures in riparian areas to avoid many impacts.

Conversion or loss of effective floodplains and wetlands is restricted on the National Forest through Executive Order. On private lands, although regulated under the federal and state permitting, some alterations and development into these areas are more likely to occur. The overall increase in federal and state support for riparian buffers is increasing the protection and limiting management in these areas. Essentially all alternatives will provide protection to riparian, floodplain, and wetland areas. Alternative F does not have these areas specifically allocated, but they are still addressed in BMPs, standards, executive orders, and other direction. The other alternatives, except Alternative I, allocated an estimated 67,000 acres in the riparian corridor (prescription 11), which will be adjusted in time with ground verification of boundaries during project planning or resource inventories. Alternative I adjusted slope factors slightly resulting in about 63,000 acres in the estimated riparian corridor. The riparian corridor widths will be expanded as needed to protect riparian and aquatic functions and values. Smaller or larger widths may be used upon interdisciplinary review and analysis.

Cumulative effects to riparian areas may occur from many types of activities and land uses. They may come in the form of natural occurrences such as floods, fire, wind, ice, disease, insects, and human-induced changes such as roads, culverts and dams that can influence migration barriers of aquatic species or alter flow dynamics. Excessive surface disturbances that cause a variety of effects separately and cumulatively. Erosion may overload sediment delivery affecting channel morphology, sediment aggradation, and flooding. Compaction, displacement, puddling and rutting of soils that cause changes to surface soil structure and subsurface water movement. Changes in soil moisture and water tables can affect plant types and densities which may influence the habitat and stability of these areas. Riparian corridors also function to delay, absorb, filter, accumulate and/or breakdown pollutants from surface runoff. The variety of conditions within the riparian moisture gradients from uplands to streams, lakes and other waters produce a wide diversity of habitats. Riparian areas are both resilient and sensitive. Activities need extra analysis to consider factors that are not normally a concern for upland areas. Because riparian corridors are very much connected to the rest of the landscape, there may be cumulative effects to consider, but evaluating these are most applicable and appropriate at the project level. Restrictions in laws, executive orders, and directives, along with the desired conditions, goals, standards, BMPs, prescription 11 and implementation guides assure a high degree of riparian awareness, protection and conservation associated with the forest plan and Forest Service actions.

Air Resources

Affected Environment

The Sumter National Forest has no wildernesses classified as Class I, according to the Clean Air Act. However, the term air quality related values (AQRV) will apply to any resources within the national forest boundary that might be affected by air pollution. Through a series of legislative and regulatory requirements, federal land management agencies have the unique responsibility to not only protect the air, land, and water resources under their respective authorities from degradation associated with the impacts of air pollution emitted outside the borders of agency lands (Clean Air Act, 1990), but to protect those same resources from the impacts of air pollutants produced within those borders (Clean Air Act, 1990, Organic Act, 1977, Wilderness Act, 1997). Activities from within the forest such as prescribed burning, road construction/maintenance, recreational use, and timber harvesting all have an impact on the air quality of the forest. It is the responsibility of federal land managers to minimize the impact of these activities on the forest's AQRV, as well as the forest's contribution to air pollution. In light of this responsibility, it is important for federal land managers to not only understand the impacts of pollution sources from activities within the national forest, but also to be familiar with the impacts from pollution sources outside the forest boundary.

The Sumter National Forest is found in an area of the United States with an increasing population and with an increasing demand for the combustion of fossil fuels to produce energy for electricity and transportation (SAMI, 2002). The forest is within a day's drive of a large percentage of the United State's population. Within 120 miles, there are 27

urban areas and numerous towns near the forest. Three major cities–Atlanta, Charleston, and Charlotte–are among the urban areas about 120 miles from the forest.

The urban areas are where the largest numbers of vehicle miles are traveled, where many coal-fired power plants are located nearby to supply electricity, and where industrial facilities are located to manufacture goods (Figure 3-6). Within 120 miles of the forest, about 28% of the nitrogen oxide emissions are released from coal-fired power plants (especially during hot summer days when electricity is needed to cool homes and businesses) and about 38% of the nitrogen oxides released come from highway vehicles. Nitrogen oxides are an important contributor to the formation of ground-level ozone on hot sunny days (Chameides and Cowling, 1995). Current ozone concentrations near the forest are at levels that exceed the new ozone National Ambient Air Quality Standards (NAAQS), which means ozone levels on many areas of the forest are likely to be unhealthy for people (Figure 3-7). Also, ozone exposures are likely to be causing growth reductions in sensitive vegetation species on the forest, and may be causing the ozone sensitive species to be less abundant in the forest (SAMI, 2002). Currently, there are laws, rules, and regulations in place that will reduce nitrogen oxide emissions by 66% by 2040 (in comparison to 1990 emission) within 120 miles of the forest (Figure 3-8). The reductions in nitrogen oxides are most likely to reduce the highest concentrations of ozone, which may result in ozone having only minimal effects on growth by the year 2040. Further nitrogen oxides are also anticipated as state and local air pollution control agencies seek ways to attain the new ozone standard in urban areas like Atlanta, Augusta, Charlotte, Columbia, Greenville, and Spartanburg. The further reductions in nitrogen oxides will have a large benefit for the health of people.

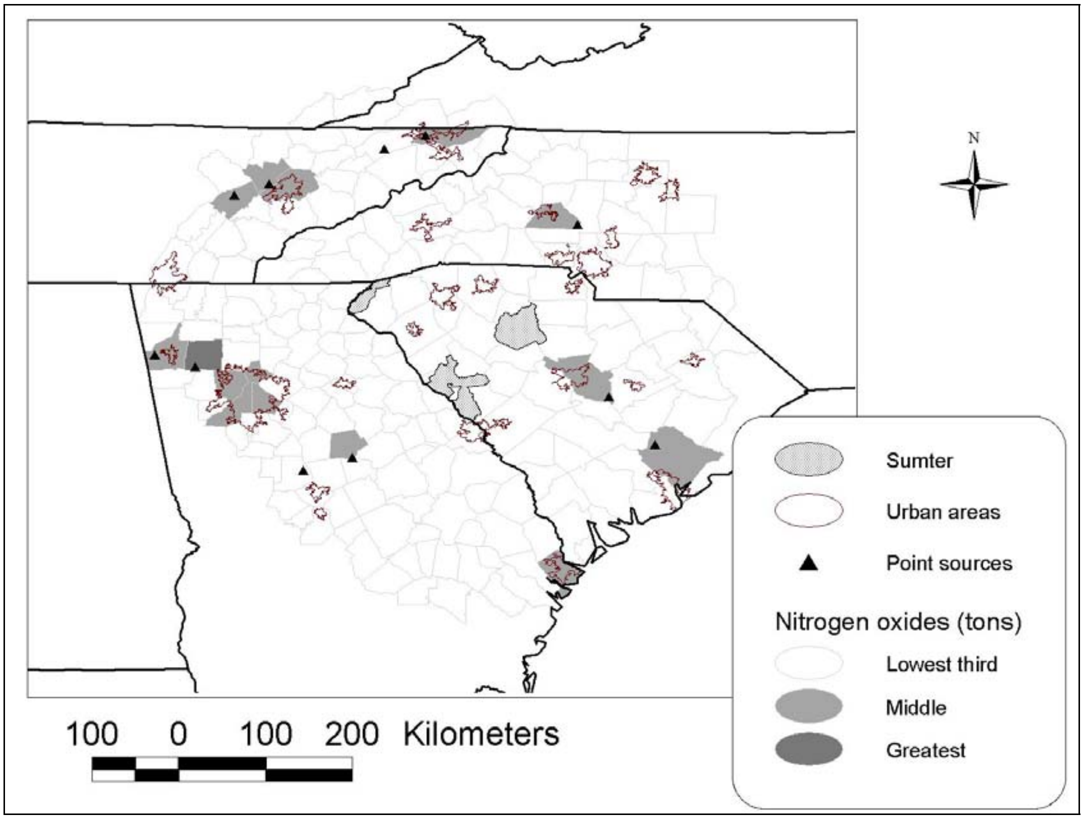


Figure 3-6. Total nitrogen oxide emission (tons) in 1990 and location of point sources of nitrogen oxides greater than or equal to 10,000 tons per year (SAMI, 2002).

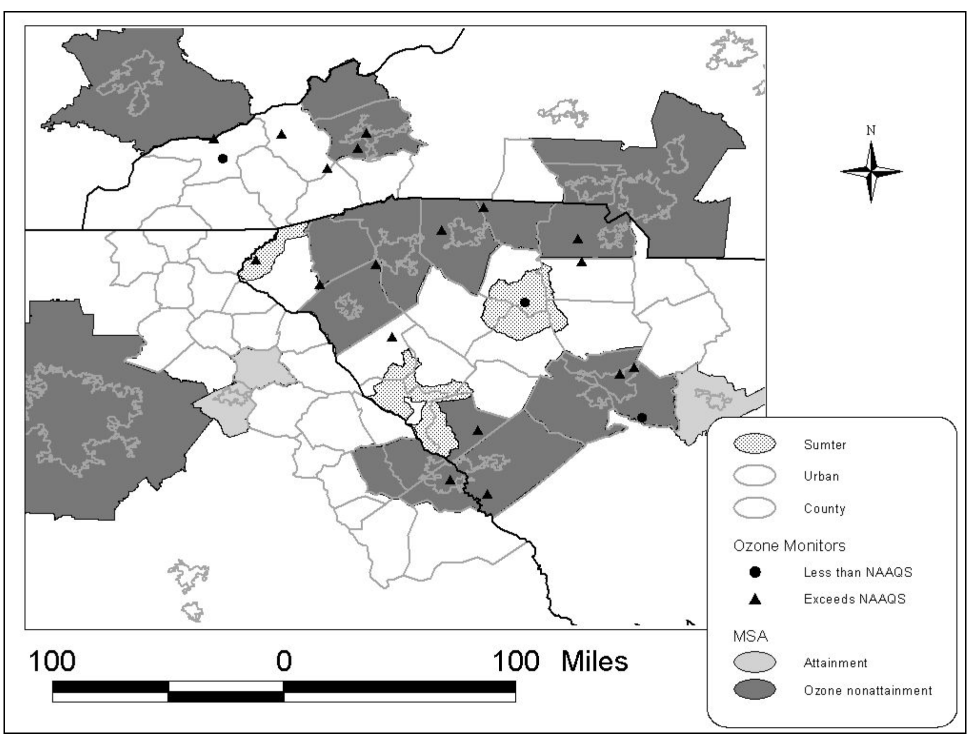


Figure 3-7. Area that could possibly be designated nonattainment for the 8-hour ozone standard based upon using 1998 through 2000 data.

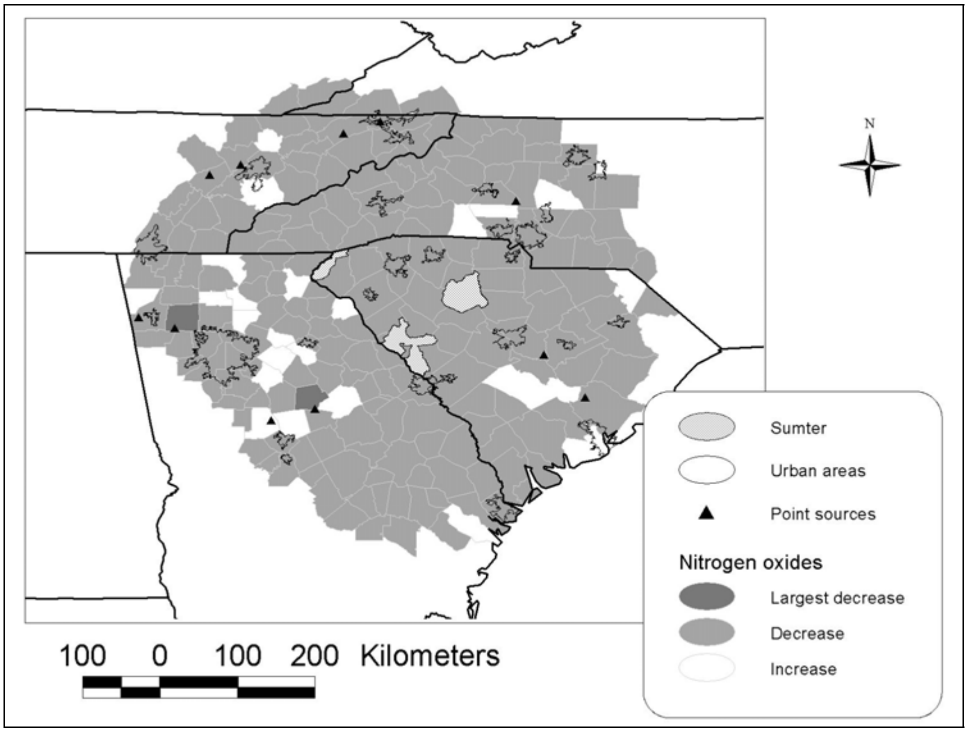


Figure 3-8. Changes in total nitrogen oxide emission (tons) in 2040 and location of point sources of nitrogen oxides greater than or equal to 10,000 tons in 1990 (SAMI,2002).

Acid compounds in clouds, fog, rain, and haze (dry deposition) are having an adverse impact on visibility and the ability of the soils and streams to buffer acid inputs (called acid neutralizing capacity, or ANC). Sulfur compounds, or sulfates, are the primary secondary compound causing these impacts and originally began as sulfur dioxide emissions. Seventy-five percent of the sulfur dioxide emissions within 120 miles of the forest are released from coal-fired power plants. Sulfur dioxide emissions are expected to decrease by 40%, or more, from sources within 120 miles of the forest by the year 2040. Currently, only the mountainous (elevations above 2,000 feet) portions of the Andrew Pickens Ranger District may be adversely impacted by acid deposition. Sampling of 10 randomly selected streams in the year 2000 had ANC values between 59.8 and 113.1 micro-equivalents per liter (mean 85.1 ± 16.87), which is at a level that should allow for healthy aquatic stream communities. However, continued decreases in stream ANC is expected for some high elevation streams because the soils have been retaining sulfates for many decades. As the sulfates are released into soil water solution, then an equivalent amount of base cations, such as calcium, will be removed from the soils. In the future (by the year 2100) the potential does exist for a small number of streams to have ANC that are below a value of 50 microequivalents per liter, a value which may indicate potential impacts to the aquatic biota.

The regional haze and reduced visibility observed in the mountains is caused mostly by air pollution – primarily sulfates that originated from coal-fired power plants. The beautiful mountain scenery is one of the main reasons tourists visit the Andrew Pickens Ranger District and other areas in Appalachia (Appalachian Regional Commission,

1970). During the last four decades, the eastern United States has seen a significant, regional reduction in visibility (IMPROVE, 2001). The estimated natural background visibility for the eastern United States is 93$\pm$28 miles (NAAP, 1991). However, there has been a significant reduction in how far a person can see distant views, as well as how clearly a person can see the mountains. Secondary fine particles ($PM_{2.5}$) are primarily responsible for the visibility impairment. Secondary fine particles are formed when combustion gases are chemically transformed into particles. In the eastern United States it is sulfate particles (transformed sulfur dioxide) from coal-fired power plants that comprise most of the measured fine particle mass (IMPROVE, 2001).

The closest visibility monitoring is conducted near the Shining Rock Wilderness (Haywood County, North Carolina), a mandatory Class I area. On the days (with a relative humidity of 80%) classified as having the lowest fine particle mass (2.26 ug/m3), the estimated visibility is 90 miles, but on the highest mass (17.57 ug/m3) days the visibility is reduced significantly to 15 miles (Figure 3-9). The days with the poorest visibility are most likely to begin occurring in May and continue through September (Air Resource Specialists, 1995) during the time when most people are visiting the forest. Throughout the year, people are most likely to see a uniform haze – like a white or gray veil – obscure the beautiful mountains (Air Resource Specialists, 1995). Sulfates are the most important fine particles contributing to visibility impairment. On the low mass days they comprise 48% of the total mass while on the highest mass days the sulfates are 71% of the total. Seventy-five percent of the sulfur dioxide emissions within 120 miles of the forest are released from coal-fired power plants. Organics (released primarily from vegetation as volatile organic compounds) are the second most important fine particles measured and if organics were the most abundant fine particles, then there would be a bluish cast to the mountains – hence the name Blue Ridge Mountains.

Figure 3-9. Visual representation at Shining Rock Wilderness using the 1994 through 1999 IMPROVE data. The image on the left shows visibility on a low fine particle mass day (90 miles), while the image on the right shows a high fine particle mass day (15 miles). Relative humidity was set at 80% when using the WinHaze model.

.

Sulfur dioxide is expected to decrease by at least 40% by the year 2040 in the counties within 120 miles of the forest. Further reductions by coal-fired power plants in North Carolina are likely to contribute to further reductions than SAMI (2002) estimated for the year 2040. SAMI did estimate what visibility may be like between the 1991 through 1995 average and the year 2040. For Shining Rock Wilderness, the annual average visibility was estimated to be 18.3 miles, but with the current laws, rules, and regulations in place, the average is expected to improve to 26.1 miles. Summertime visibility is worse, with an average of 10.9 miles. The SAMI (2002) estimates for summertime visibility are expected to improve by the year 2040 to 19.5 miles.

The fine particles that cause visibility impairment are also of concern because high concentrations can be unhealthy for people, since they are primarily associated with the aggravation of respiratory conditions such as asthma. Fine particles are closely associated with increased hospital admissions and emergency room visits for heart and lung disease, increased respiratory disease and symptoms such as asthma, decreased lung function, and even premature death. Sensitive groups are at greater risk and include the elderly; individuals with cardiopulmonary disease, such as asthma; and children. For this reason, fine particle levels are monitored, and the Environmental Protection Agency has established NAAQS for fine particles, also called $PM_{2.5}$. Table 3-5 presents results for monitors near the forest and these results indicate the 24-hour fine particulate standard (please note the maximum values are presented and not the 98th percentile) is unlikely to exceed the NAAQS when the data from the monitoring sites closest to the forest are averaged for three years. However, the annual average fine particle concentration is either close or has exceeded levels considered unhealthy for people (15 ug/m^3) near the

Long Cane Ranger District (currently Greenwood County and possibly Edgefield County in the future).

Table 3-5. Monitoring results for particulate matter 2.5 microns ($PM_{2.5}$) and smaller in size for the year 1999 through 2001.*

LOCATION (County)	Site ID	1999 Maximum 24-hour (ug/m^3)	1999 Annual Average (ug/m^3)	2000 Maximum 24-hour (ug/m^3)	2000 Annual Average (ug/m^3)	2001 Maximum 24-hour (ug/m^3)	2001 Annual Average (ug/m^3)
Edgefield	450370001	36.3	15.13	31.5	14.78	31.6	13.01
Greenwood	450470003	36.0	15.71	34.5	15.51	31.4	13.97
Oconee	450730001	33.9	13.42	32.7	12.63	42.7	11.82

* The National Ambient Air Quality Standard is violated if the average of 3-years of annual means is 15 ug/m3 or greater (multiple community oriented monitors can be averaged together), or the 3-year average of the 24-hour concentration for the 98th percentile (using the maximum population oriented monitor in an area) is the 65 ug/m3 or greater.

No portions of the forest are anticipated to be designated as nonattainment for the fine particle (and ozone) NAAQS. The Environmental Protection Agency determines whether any other portions of the forest will be designated as nonattainment for fine particles or ozone. It is of particular importance for fire managers to mitigate prescribed fire emissions, to the greatest extent practical, during those days characterized by existing or predicted high ambient air pollution. The $PM_{2.5}$ standard may require fire managers to be even more vigilant in protecting the health and welfare of citizens on and off forest lands from the effects of particulate matter emissions associated with prescribed fire.

Once an area is designated nonattainment, a State Implementation Plan is developed in attempt to bring the area back into attainment of the standard. This usually involves placing controls on various sources that contribute to the pollutant of concern in order to lessen or minimize the emissions. The forest will need to interact with the South Carolina Department of Health and Environmental Control and the South Carolina Forestry Commission to ensure that forest prescribed fire emissions (and perhaps other forest activities) are considered in the state implementation plan development, since 70% of the emissions from prescribed fires are fine particles, and nitrogen oxides and volatile organic compounds are also released.

Direct/Indirect and Cumulative Effects

Land management and recreational activities conducted on the forest do contribute to air quality degradation in combination with other air pollution emissions in the region. Most of the emission activities (such as highway vehicle use) from Forest Service activities are already accounted for in emissions inventories. However, the single most important Forest Service management activity that could deviate from the emissions inventory is for prescribed fires. Therefore, this analysis will be limited to evaluating how county level total emissions of fine particles will change with the alternatives.

The Southern Appalachian Mountain Initiatives (SAMI) database was used to estimate primary fine particulate matter ($PM_{2.5}$) emissions (SAMI, 2002) for the 10 counties that intersect the forest. Total fine particulate matter emissions in the year 1990 were estimated to be 13,666 tons and by the year 2040, the emissions are predicted to increase to 15,284 tons. The agriculture and forestry sector was estimated to have 674 tons of fine particles in 1990 and to have 1,023 tons by the year 2040. It should be noted that it can not be determined how much of the agriculture and forestry total are attributed to Forest Service prescribed fires.

Table 3-6 lists the estimated emissions of fine particulates for each of the alternatives and the emissions are directly related to the number of acres to receive prescribed fire treatment each year. Only Alternative G is below the agriculture and forestry 1990 totals obtained from the SAMI database, while all the other alternatives exceeded the 2040 levels predicted by SAMI. Most likely though, the SAMI emission inventory for fine particulates emissions has not anticipated all of the emissions for any of the Forest Service alternatives. Therefore, it is critical for the forest to work with the South Carolina Department of Health and Environmental Control and others to include Forest Service emissions in future emissions inventories.

Table 3-6. Estimated fine particulate emissions for each of the Alternatives using Environmental Protection Agency emission factors (U. S. EPA, 1996).

Alternative	**Acres**	**Fuel Consumed (tons per acre)**	**$PM_{2.5}$ (pounds per ton of fuel consumed)**	**$PM_{2.5}$ Emissions (tons)**
A	19,573	4	28	1,096
B	33,031	4	28	1,850
D	20,054	4	28	1,123
E	33,185	4	28	1,858
G	10,355	4	28	580
I	23,527	4	28	1,318
F-current	19,379	4	28	1,085

Sulfates are the primary fine particles measured at remote monitoring sites near the Class I areas (SAMI, 2002). Currently, the emissions from prescribed fires are not expected to be a large contributor to the total fine particulate matter mass and consequently to exceed the fine particle National Ambient Air Quality Standard (NAAQS). However, the forest will be expected to follow conformity determination rules and disclose any prescribed fire activities in nonattainment areas. Most likely, this will include any prescribed burn projects in Greenwood County.

Minerals

Affected Environment

The United States holds title to all of the minerals beneath 99.9% of the forest. Forest tract L-446, containing 358.4 acres, is the only tract on the forest where the United States does not own the mineral rights. The mineral rights under this tract are considered outstanding. Outstanding mineral rights are property rights that were established and separated from the surface estate prior to the Forest Service's acquisition of the surface estate. The Bureau of Land Management (BLM) manages the mineral estate where the United States holds title and the Forest Service administers the surface estate. There are no active mines on the national forest at this time. The Plan of Operations for a Preference Right Lease Application for Gold has been approved for 1100 acres on the Long Cane District. A Prospecting Permit Plan of Operations has been approved on the Long Cane District and a Prospecting Permit Application has been received for 200 acres on the Long Cane District.

Gold panning, as a recreational activity, has been occurring on the forest for many years. The Andrew Pickens Ranger District is where the majority of gold panning has occurred, with the Long Cane District close behind.

There are 362,850 acres on the Sumter National Forest. This acreage falls within three categories for mineral leasing purposes. The first category consists of lands not available for lease. These lands have either been withdrawn from mineral entry administratively, by law, or the forest has determined that a prescription goal cannot be accomplished if the lands were open to mineral entry. Only 2.7% of the forest falls within this category. The second category allows leasing, but there are No Surface Use or Controlled Surface Occupancy Stipulations attached to any lease issued on these lands; 4.4% of the forest falls within this category. The third category consists of lands that are available for lease with standard lease stipulations. Most lands on the forest, 92.9%, fall within this category.

Direct/Indirect Effects

The determination of effects for each alternative was measured by the percentage of the forest available for federal leasing under each alternative as shown in Table 3-7.

Alternative A (Goods and Services)**:** In this alternative, 71.4% of the forest would be available for lease with standard lease stipulations; 24.4% would be available with lease restrictions; and 4.2% would not be available for lease under any circumstances.

Alternative B (Biologically Driven)**:** This alternative emphasizes restoring the natural resources and creating and maintaining wildlife habitats. Available for leasing with standard lease stipulations would be 63.7% of the forest; 32.5% would be available with lease restrictions; and 3.8% would not be leased.

Alternative D (Balanced Age Class)**:** This alternative would allow the forest to reach and maintain a balanced age class. Available for mineral leasing with standard lease stipulations would be 74% of the forest; 23.4% would be available for mineral leasing but with restrictions; and 2.6% would not be available for leasing.

Alternative E (Recreation)**:** This alternative allows for most areas of the forest to maintain a forested canopy with large blocks of the forest being maintained in a roadless condition. Under this alternative, 59.9% of the forest would be available for mineral leasing; 36.6% would be available for lease with restrictions; and 2.7% not available for lease.

Alternative G (T&E species and watershed restoration)**:** This alternative provides for the inventory, monitoring, conservation, and recovery of proposed, threatened, endangered, sensitive, and locally rare species, with riparian areas maintained as old growth for habitat and connectivity. Under this alternative, 50.5% of the forest would be available for mineral leasing with standard lease stipulations; 45.7% would be available for lease with restrictions; and 2.7% would not be available for lease.

Alternative I (Preferred)**:** The preferred alternative allows for the leasing of 63.4% of the forest with standard lease stipulations; 33.6 % with restrictions (1.8% of the acreage in this category contains the No Surface Use restriction); and 3.0% where no leasing would be allowed.

The direct effect of each of the alternatives would be to increase the percentage of the forest available for lease with certain restrictions by 33.6 % and reduce the amount of acreage available for lease with standard stipulations by 33.1%. The total acreage available for lease will remain virtually the same. The acreage added to the restricted category will indirectly make mineral operations on the forest more expensive for companies or individuals, but allow for increased resource protection on the forest.

Table 3-7. Percentage of Forest Affected by Each Alternative

Alternatives	Not Available for Lease	No Surface Occupancy or Controlled Surface Use Stipulations	Available for Lease with Standard Stipulations
Alternative A	4.2	24.4	71.4
Alternative B	3.8	32.5	63.7
Alternative D	2.6	23.4	74.0
Alternative E	3.5	36.6	59.9
Alternative F	2.7	4.4	92.9
Alternative G	3.8	45.7	50.5
Alternative I	3.0	33.6	63.4

Cumulative Effects

Cumulative effects cannot be determined due to the uncertain nature of mineral exploration and development. Any lease issued will not have 100% surface disturbance.

BIOLOGICAL ELEMENTS

Major Forest Communities

The Forest Service maintains a continuous inventory of stand conditions (CISC), which includes forest types. To aid in analysis, major forest communities on the Sumter National Forest have been organized around forest community types described in *Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region*. The following table displays a crosswalk between the Southern Region's CISC forest types and old growth community types, as well as the relative distribution of these community types across the forest. The relationship between major forest communities discussed in this section to community types displayed in Table 3-8 is described in the affected environment section for each major forest community.

Table 3-8. Current composition of forest communities analyzed in the SPECTRUM model for the Sumter National Forest plan revision.

Piedmont (Enoree and Long Cane Districts)

Community Type (Spectrum Strata)	Site index	Forest Type (CISC Codes)	% Forested Acres
Dry - Mesic Oak (P21)	>65	Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	8.3
Dry – Xeric Oak (P22)	<=65 (hdwd) <60 (pine)	Eastern red cedar – hardwood (11) Shortleaf pine - oak (12) Loblolly pine - hardwood (13) Pitch pine – oak (15) Longleaf pine (21) Loblolly pine (31) Shortleaf pine (32) Virginia pine (33) Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	0.5
Dry, Dry – Mesic Oak and Oak-pine (P52)	>=50	Upland hardwoods – white pine (42) Oak – Eastern red cedar (43) Southern red oak – yellow pine (44)	0.6

		Chestnut oak – scarlet oak – yellow pine (45) White oak – black oak – yellow pine (47) Northern red oak – hickory – yellow pine (48) Bear oak – scrub oak – yellow pine (49)	
Dry, Dry – Mesic Pine and Pine-oak (P25x)	>=60	Eastern red cedar – hardwood (11) Shortleaf pine - oak (12) Loblolly pine - hardwood (13) Longleaf pine (21) Loblolly pine (31) Shortleaf pine (32) Virginia pine (33)	58.9
Mixed Mesophytic Forest (P05)	>=50	Cove hardwood – white pine – hemlock (41) Yellow poplar (50) Yellow poplar-white oak-northern red oak (56)	0.5
Bottomland, Riverfront Forest (P13)	>=50	Bottomland hardwood/yellow pine (46) Sweet gum/yellow poplar (58) Swamp chestnut oak – cherrybark oak (61) Sweet gum - nuttall oak - willow oak (62) Sugarberry – American elm – green ash (63) Laurel oak - willow oak (64) Overcup oak – water hickory (65) Sweet bay – swamp tupelo – red maple (68) Beech – magnolia (69) Black ash – American elm – red maple (71) River birch – sycamore (72) Cottonwood (73) Willow (74) Sycamore – pecan – American elm (75) Silver maple – American elm (76) Black walnut (82)	7.9

Mountains (Andrew Pickens District)

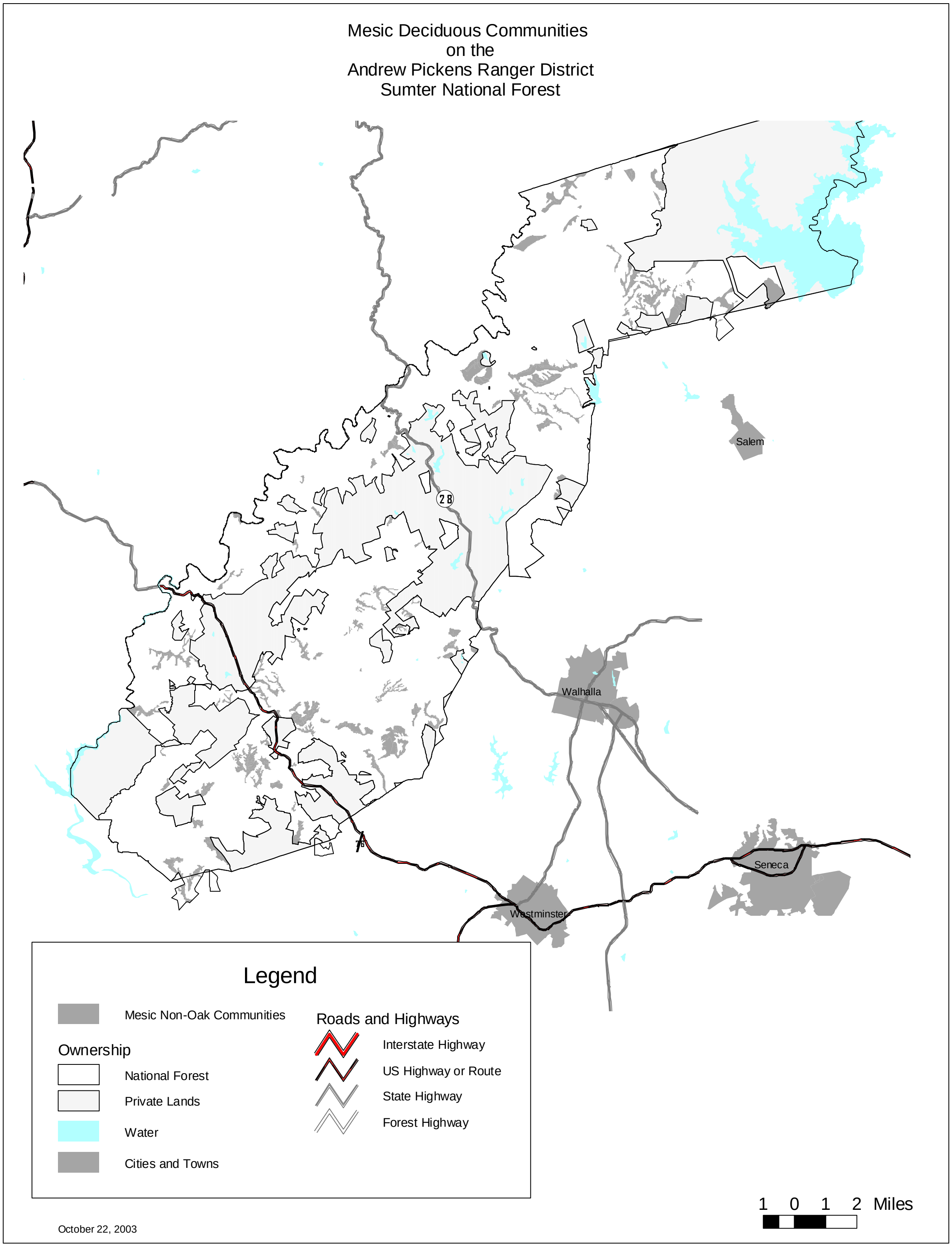
Community Type	Site index	Forest Type CISC Codes	% Forested Acres
Dry - Mesic Oak (M21)	>65	Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	4.4

Dry – Xeric Oak (M22)	<=65 (hdwd) <60 (pine)	White pine – upland hardwood (10) Shortleaf pine - oak (12) Pitch pine – oak (15) Virginia pine – oak (16) Shortleaf pine (32) Virginia pine (33) Pitch pine (38) Table Mountain pine (39) Post oak – black oak (51) Chestnut oak (52) White oak – northern red oak – hickory (53) White oak (54) Northern red oak (55) Scrub oak (57) Scarlet oak (59) Chestnut oak – scarlet oak (60)	0.5
Dry, Dry – Mesic Oak and Oak-pine (M52)	>=50	Upland hardwoods – white pine (42) Oak – Eastern red cedar (43) Southern red oak – yellow pine (44) Chestnut oak – scarlet oak – yellow pine (45) White oak – black oak – yellow pine (47) Northern red oak – hickory – yellow pine (48) Bear oak – scrub oak – yellow pine (49)	2.8
Dry, Dry – Mesic Pine and Pine-oak (M25)	>=60	White pine – upland hardwood (10) Shortleaf pine - oak (12) Pitch pine – oak (15) Virginia pine – oak (16) Shortleaf pine (32) Virginia pine (33) Pitch pine (38) Table Mountain pine (39)	7.9
Mixed Mesophytic Forest (M05)	>=50	White pine (3) White pine – hemlock (4) Hemlock (5) Hemlock – hardwood (8) White pine – cove hardwood (9) Red spruce – northern hardwood (17) Cove hardwood – white pine – hemlock (41) Bottomland hardwood – yellow pine (46) Yellow poplar (50) Yellow poplar-white oak-northern red oak (56) Swamp chestnut oak – cherrybark oak (61) Sweet gum - nuttall oak - willow oak (62) Sugarberry – American elm – green ash (63) Laurel oak - willow oak (64) Overcup oak – water hickory (65) Sweet bay – swamp tupelo – red maple (68) Beech – magnolia (69) Black ash – American elm – red maple (71)	5.7
Loblolly Pine (M53)	>=50	Loblolly pine - hardwood (13) Loblolly pine (31)	1.9

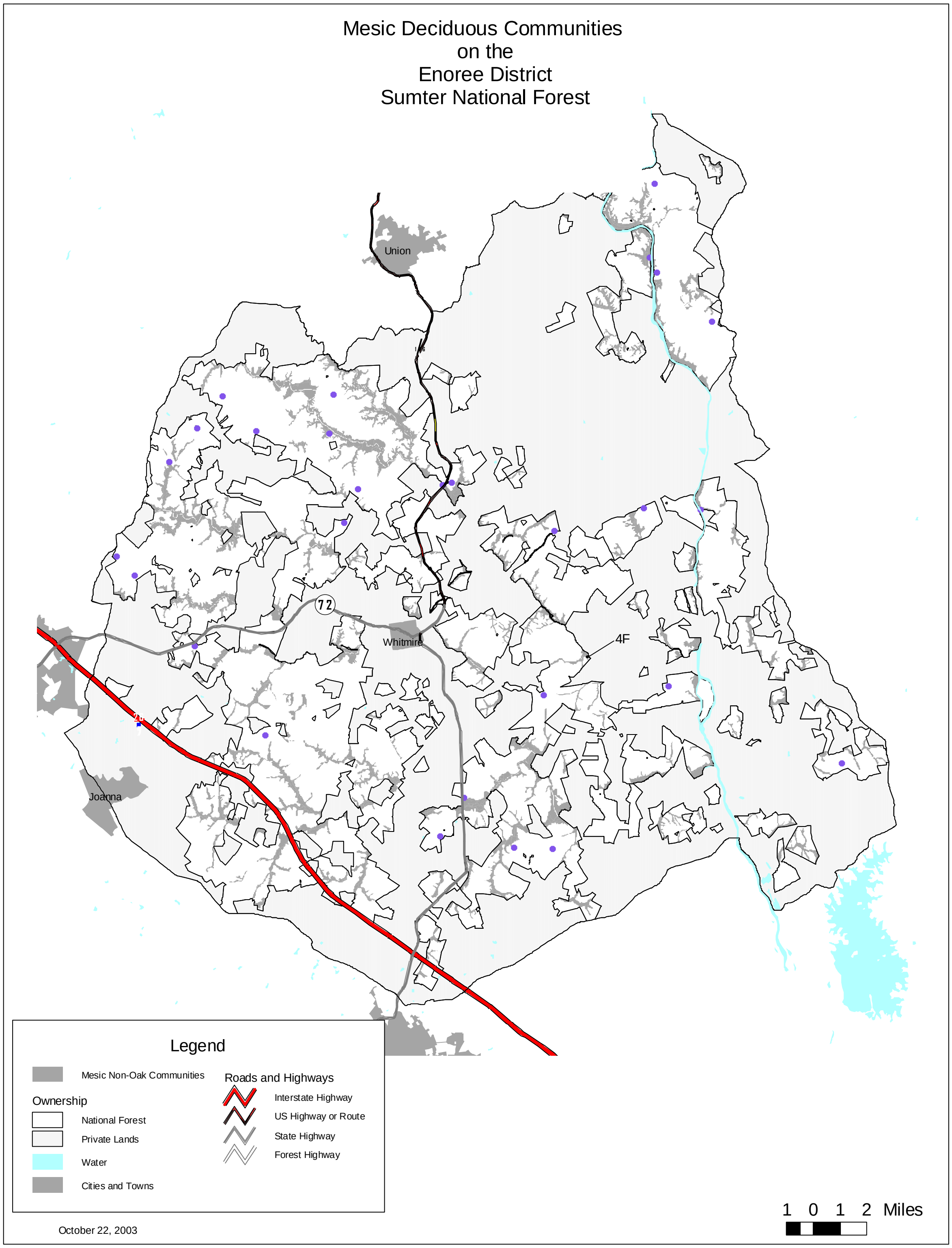
Mesic Deciduous Forests (non-oak)

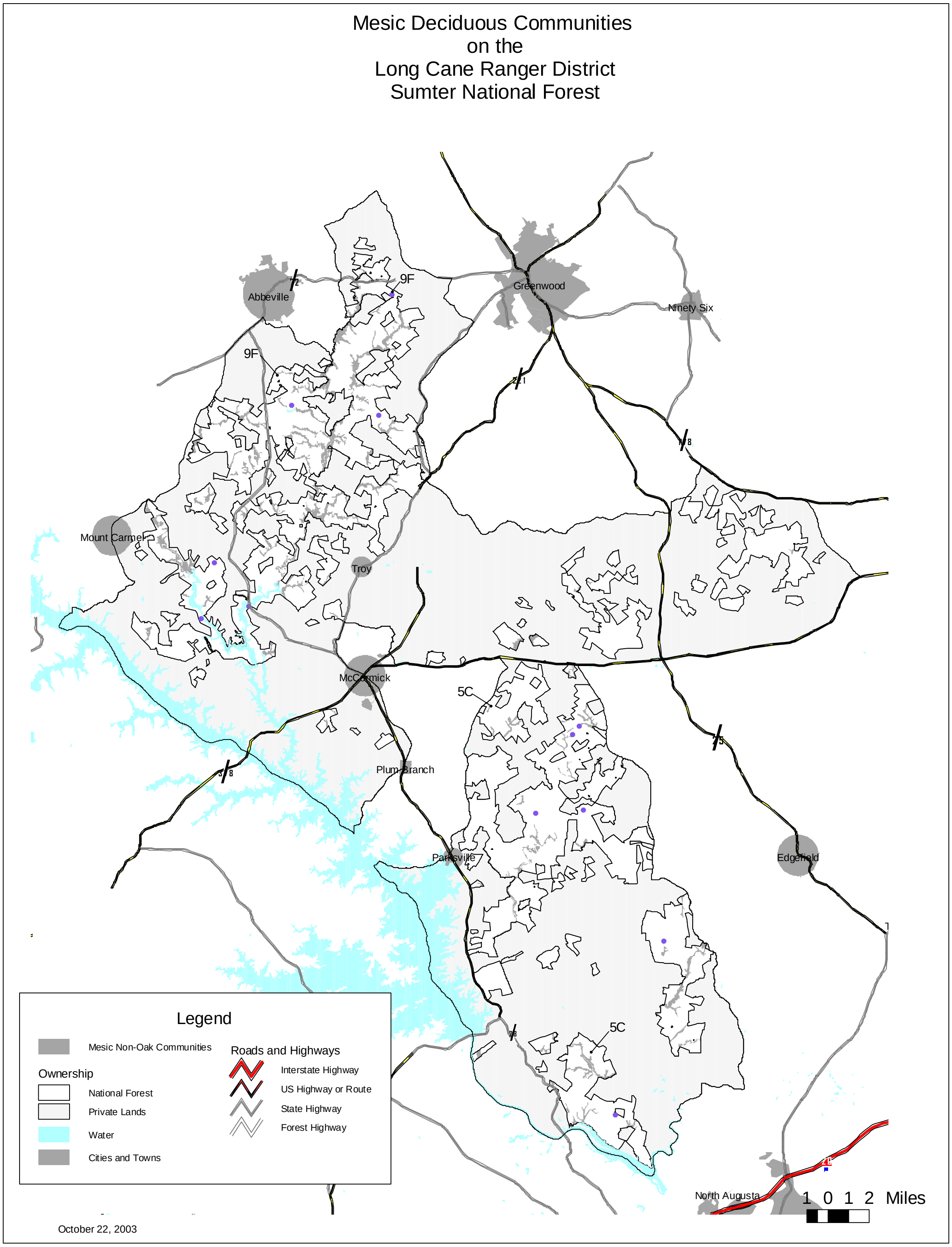
Affected Environment

The mesic deciduous forests covered in this section include northern hardwood, mixed mesophytic, river floodplain hardwood, and eastern riverfront community types (USDA Forest Service, 1997). Mesic deciduous forest types are characterized by the presence of many shade tolerant tree species and relatively low levels of fire occurrences and are found predominantly on north and east facing slopes, in coves, or in bottomland situations. Soil and moisture conditions in these situations are conducive to rapid tree growth, well developed understory and midstory levels, and large diameter trees with cavities. The forest types included here are not fire adapted and contain a higher incidence of species that are fire intolerant than other major forest communities.



Mesic Deciduous Communities
on the
Andrew Pickens Ranger District
Sumter National Forest
28
Salem
Walhalla
Seneca
Westminster
Legend
Mesic Non-Oak Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003


Mesic Deciduous Communities
on the
Enoree District
Sumter National Forest
Union
Whitmire
Joanna
72
4F
Legend
Mesic Non-Oak Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003


Mesic Deciduous Communities
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
9F
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
5C
Plum Branch
Parksville
Edgefield
North Augusta
Legend
Mesic Non-Oak Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003

Abundance

In the Southern Appalachian Assessment Area, mesic deciduous forest communities such as northern hardwood, mixed mesophytic hardwood, and bottomland hardwood forests comprise 1.6, 8.4, and 1.2 % of the land area of the SAA area.

The current acreage of mesic deciduous forests for the Sumter National Forest is shown in Table 3-9. Although a relatively small proportion of the forest (8% in the mountains), mesic deciduous forests are well distributed on the Andrew Pickens District. Mesic deciduous forests are about as equally common on the piedmont districts (11%), but are primarily concentrated in the bottoms and drains of major river systems.

Table 3-9 Current acreage (m acres) and percent of mesic deciduous forest by successional class, the percent of total mesic deciduous forest acreage in mid- and late-successional stages, and the percent of total forest acres in mid- to late-successional mesic deciduous forests for the Sumter National Forest, 2002.

	Piedmont	Mountains
Early Successional	.01 (-)	0.4 (-)
Sapling/Pole	0.7 (2.2%)	1.8 (21 %)
Mid- Successional	3.4 (11%)	1.0 (17%)
Late-Successional (including Old Growth)	26.2 (87%)	4.5 (61%)
Total	30.2	7.4
Total acres of mid- and late-successional mesic deciduous forests	30.2	5.6
% of total mesic deciduous forest acres in mid- and late-successional stages	98%	93%
% of total forested acres in mid- and late-successional mesic deciduous forests	11%	6.7%

Age Class Distribution

For the Southern Appalachian Assessment Area, the majority of the mesic deciduous forests are currently in older age classes. Across all ownerships, approximately 75-80% of maple-beech-birch (northern hardwoods), oak-hickory, and elm-ash-cottonwood (bottomland hardwoods) forests are in mid- and late-successional stages (SAMAB 1996: 165). There are approximately 3.5 million acres of deciduous forest on national forest lands within the SAA area (SAMAB 1996:168). Of these acres, 2% are in early-successional forest, 6% are in the sapling/pole forest, 45% are in the mid-successional forest, and 46% are in late-successional forest.

A key management issue for this community is maintenance of a high proportion of this type in mid-and late-successional conditions to provide habitat for associated species. There are a number of viability concern species that are broadly associated with mature mesic deciduous forests, and others that are more specifically associated with such forests at high elevations (Appendix F).

The current age class distribution of mesic deciduous forests for the Sumter National Forest is shown in Table 3-9. Nearly all of these forest communities are in mid- and late-successional stages in the piedmont, and a majority in the mountains. These older deciduous forest make up less than 25% of the total forest acres in the mountains, and, because of its more limited distribution, approximately 11% in the piedmont.

Forest Structure

A number of bird species favor mature, mesic hardwood forests with a diverse and well-developed canopy structure including canopy gaps and associated midstory and understory structural diversity. (Ramey, 1996; Buehler and Nicholson, 1998; Rodewald and Smith, 1998; Nutt, 1998). Species of potential viability concern associated with canopy gaps and structurally diverse understories in mesic deciduous forests are identified in Appendix F. This structural diversity may be characteristic of the decadent, patchy conditions found in old growth forests, to which these species have presumably adapted. While a growing portion of the landscape in the Southern Appalachians consists of large hardwoods, most sites have very simple canopy structures (Runkle, 1985). This lack of structure is likely the result of previous even-aged timber management, resulting in forest stands of approximately similar-aged trees with low mortality and few canopy gaps. Most of these mid- and late-successional forests have not yet begun to develop the canopy gaps characteristic of old growth forests

Intermediate treatments such as thinning can be used to improve forest structure in mesic deciduous forests. Canopy gaps created by these treatments would stimulate the development of the desired midstory and understory structure. Single-tree selection or small group selection (generally <0.75 acre group maximum size), implemented at relatively low intensities, achieves very similar desired conditions.

Management Indicators

Several management indicators have been identified for assessing effects to mesic deciduous communities. These include both management indicator species (MIS) and key habitat variables.

The hooded warbler (*Wilsonia citrina*) is a neotropical migrant that is fairly common to common throughout the southeastern United States during the breeding season (Hamel 1992). It is found in mixed hardwood forests of beech, maple, hickory and oaks with dense undergrowth (DeGraaf et.al. 1991). It nests in saplings, shrubs, or herbaceous

vegetation. It also has been identified as a MIS for mesic deciduous forests with canopy gaps and structurally diverse understories. The hooded warbler is common throughout the Sumter National Forest. Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Key habitat variables identified for this community are total acres of mid- and -late successional mesic deciduous forests, and total acres treated to create canopy gaps.

Direct and Indirect Effects

Abundance and Age Class Distribution

The amount of regeneration treatments will affect the future quantity and distribution of mid- and late-successional mesic deciduous forests. The future age class distribution of mesic deciduous forests would vary among alternatives due to the differences in management intensity and emphasis. Table 3-10 shows the expected percentage in mid- and late-successional mesic deciduous forest for each alternative after 10 and 50 years of implementation based on SPECTRUM model outputs.

Table 3-10.. Expected percentage in acreage of mid- and late-successional mesic deciduous forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives (derived from SPECTRUM models).

	Piedmont		Mountains	
Alternative	Yr10	Yr50	Yr10	Yr50
Alternative A	11	7.8	5.7	6.4
Alternative B	10	9.4	4.7	6.4
Alternative D	11	7.8	5.6	5.1
Alternative E	11	9.4	5.6	6.6
Alternative F	11	2.4	5.4	4.6
Alternative G	10	10	5.3	7.3
Alternative I	10	9.1	5.4	6.9

Forest Structure

Expected activity levels related to the creation of canopy gaps for all alternatives are shown in Table 3-11 for the Sumter National Forest.

Table 3-11. Expected activity levels related to the creation of canopy gaps in mesic deciduous forests for the Sumter National Forest by alternative.

Mountains

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Acres of mid and late successional mesic hardwood forests to be treated to create canopy gaps during first decade of plan implementation	0.3	0.5	0.4	0.6	0.4	0.1	0.6
Percent of current total acres of this habitat type to be treated	1.6	2.8	1.9	3.0	2.1	0.4	2.8

Piedmont

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Acres of mid and late successional mesic hardwood forests to be treated to create canopy gaps during first decade of plan implementation	0.7	3.1	0.6	3.1	0.2	0.1	1.8
Percent of current total acres of this habitat type to be treated	2.2	10.2	2.0	10.2	0.8	0.1	5.8

Canopy gap treatments that enhance structural diversity in mature mesic hardwoods would benefit species such as hooded warbler as well as numerous other species associated with these habitat conditions. In the short-term, alternatives that provide for more creation of structural diversity in close-canopied mesic deciduous forests are expected to support larger populations of this species than alternatives that provide less of this condition, in fact the highest population densities for hooded warbler are expected in these situations. Average breeding densities reported by Hamel (1990:C-8) are 16.0 pairs per 100 acres. Populations are expected to be highest under alternatives that provide for more creation of canopy gaps and older decadent forests (Alternatives B, E, I). In the long term, alternatives that provide the highest levels of late-successional mesic deciduous forests are most likely to support the largest populations of this species (Alternatives B, E, G, I). Inventory and monitoring of this species would be used to document occurrences and population response to effects of management on canopy structure in nearby habitat.

Cumulative Effects

Mesic deciduous forests are not very abundant (<10%) but are relatively common (36,000 acres) on the Sumter National Forest. The distribution of age classes is however, concentrated heavily (>90%) in the mid- to late-successional stages (Table 3-9). While increasingly vulnerable to insect and disease attacks because they are so similar in age

and condition, the vast majority of acres in mesic deciduous forests display a more linear pattern and are spotty across the landscape compared to other major forest communities on the forest. Management opportunities would allow for altering stand structure and regenerating some mesic deciduous forest in all alternatives except G. Maintenance and restoration of an age class distribution or "within stand" structural diversity for mesic deciduous forest may be necessary in the near future to provide for plants and animals associated with these habitats. It is not expected that private landowners will restore or manage to maintain significant amounts of high quality mesic deciduous hardwood forest, and they would remain limited in distribution and abundance on the landscape except for national forest maintenance and restoration efforts.

Eastern Hemlock and White Pine Forests

Affected Environment

Eastern hemlock and white pine forests are broadly defined to include those forested communities with a canopy that is either dominated or co-dominated by eastern hemlock (*Tsuga canadensis*) or eastern white pine (*Pinus strobus*). These forest types are the predominant components of the conifer-northern hardwood community type described in the regional old-growth guidance (USDA Forest Service, 1997). For the purposes of this analysis, forests with a significant component of eastern hemlock are classified as hemlock forests, even where white pine may be dominant. White pine forests include all other forest types where white pine is dominant. This division puts priority on the presence of hemlock as a key habitat component. Hemlock and white pine forests are a subset of the mixed mesophytic forest displayed in Table 3-12 (CISC types 3, 4, 5, 8, 9, 10).

Table 3-12. Current acreage (m acres) and percent of hemlock and white pine forest by successional class, the percent in mid- and late-successional stages, and the percent of total forest acres in mid- to late-successional hemlock and white pine forests for the Sumter National Forest (mountains only), 2002.

Successional Stage	M Acres and %
Early Successional	0.1 (0.6%)
Sapling/Pole	4.0 (27%)
Mid- Successional	2.3(16%)
Late-Successional (including Old Growth)	8.4 (56%)
Total	14.8
Total acres of mid- and late-successional hemlock white pine forest	10.7
% of total hemlock white pine forest acres in mid- and late-successional stages	72%
% of total forested acres in mid- and late-successional hemlock white pine forests	13%

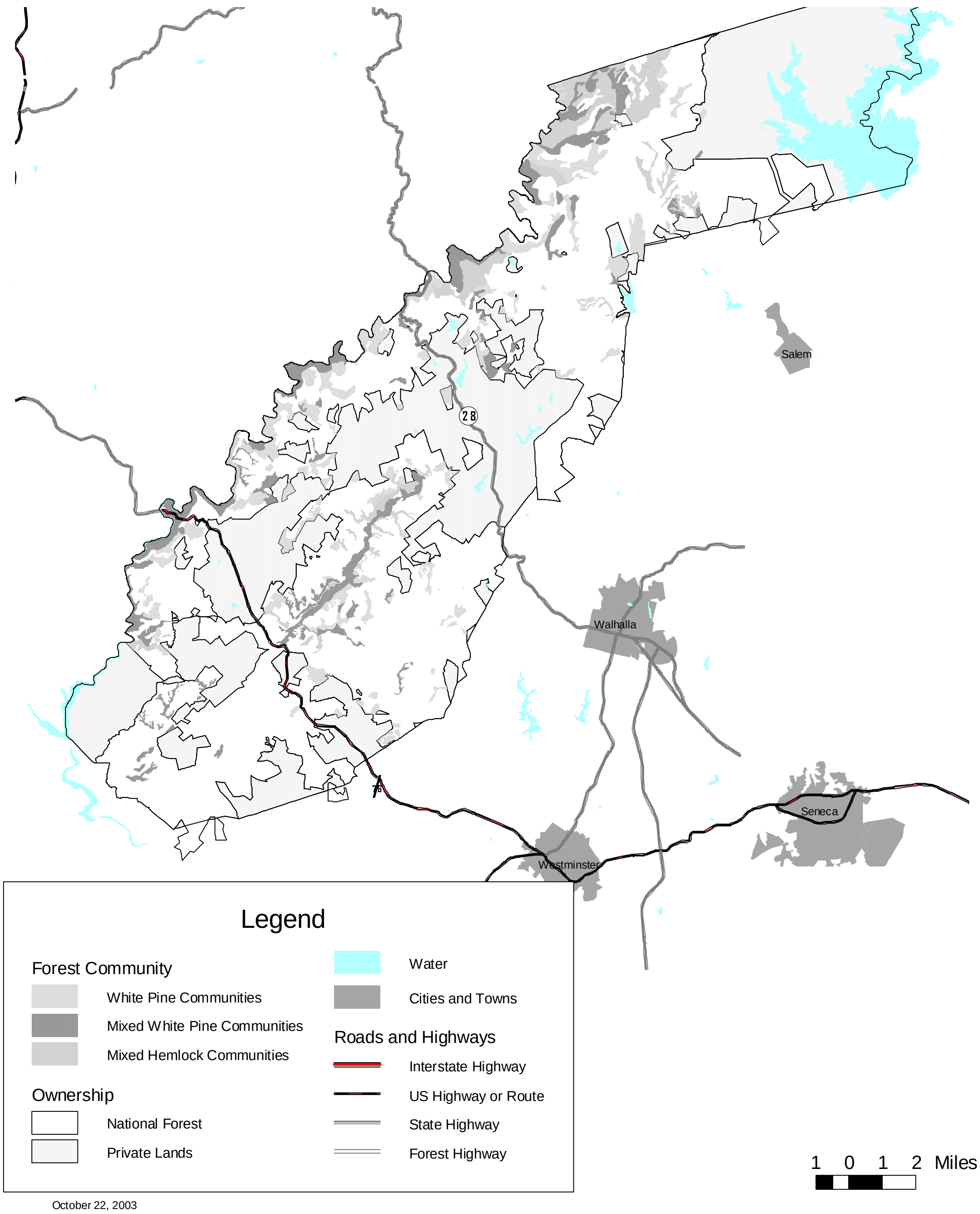
Eastern hemlock forests typically occur on acidic soils and often have a dense shrub layer composed of ericaceous species. These communities are typically low in herbaceous diversity, but may support rich bryophyte communities. White pine forests occupy similar sites but also may occur on dryer locations, particularly in areas where fire has been suppressed. White pine forests have also been artificially created as timber plantations.

The combination of a largely evergreen canopy and a dense midstory in naturally occurring hemlock and white pine forests provide for a variety of benefits, including shading and cooling of riparian systems, thermal cover for wildlife, and nesting and foraging habitat for several species of neotropical migrant birds dependent upon the layered canopy structure and understory thickets (Rhea and Watson 1994). There is some evidence that hemlock-white pine forests provide necessary habitat components for the long-term conservation of red crossbills (Dickson 2001). Eastern hemlock forests may also be important refugia for species typically adapted to higher elevations. Dickson (2000) states that red-breasted nuthatches, winter wrens, and golden-crowned kinglets are found in late successional hemlock forests down to elevations of 2,000 feet, and several species of rare bryophytes that are known to occur primarily within the spruce/fir zone are also found at lower elevations in humid gorges, often under a canopy that includes eastern hemlock (Hicks 1992).

In 1996, the Southern Appalachian Assessment (SAMAB 1996) estimated that there were 617,687 acres of "white pine-hemlock forests" across all land ownerships in the Southern Appalachians representing 2.5% of the total land base. This figure represents data collected from FIA, CISC, and LANDSAT imagery. The current amount and distribution of mature eastern hemlock forests is threatened by the recent emergence of the hemlock woolly adelgid in the Southern Appalachians. First identified in the eastern United States near Richmond, VA, in 1924, this exotic pest has recently spread into the Southern Appalachians and threatens to spread throughout the range causing mortality within 5 years after initial infestation (SAMAB 1996).

On the Sumter National Forest, eastern hemlock forests are found primarily in association with north facing coves, slopes, and in riparian areas. Years of fire suppression across the Andrew Pickens District has allowed white pine, and occasionally hemlock, to creep upslope onto more xeric slopes and ridges. Once established, these species gradually alter the vegetative community from the dense shade and heavy needle cast. The Andrew Pickens District is at the southern end of the range for hemlock and there are approximately 3,500 acres of hemlock and hemlock/mixed forest types on the forest. There are currently approximately 7,500 acres of white pine forest types, 2,500 acres of which originated as plantations.

White Pine and Hemlock Communities
on the
Andrew Pickens Ranger District
Sumter National Forest



Management Indicators

Two key habitat variables are selected as management indicators to monitor the condition of eastern hemlock and white pine forests: the number of acres of hemlock forests infested with hemlock woolly adelgid and the number of acres of white pine plantations restored to diverse native communities. The selection and monitoring of management indicator species may be an appropriate tool when a clear correlation between a specific management activity and the population trend of the species is known. Because the main factor that may cause a decline in hemlock forests and associated species is the hemlock woolly adelgid rather than management, it is not meaningful to select management indicator species for this community type.

Direct and Indirect Effects

Abundance

The amount and distribution of white pine forests has increased over its natural abundance through the establishment of plantations and a process of upland encroachment that is a result of years of fire suppression. White pine plantations are often closed canopy stands with little botanical diversity. The draft forest plan includes objectives to restore these plantations back to diverse native communities appropriate to the site. With an additional renewed emphasis of introducing fire onto the landscape in areas where natural fire may have played a role in shaping historic vegetative patterns, it is likely that white pine distributions will shrink from areas where it has been able to become established in the absence of fire. Table 3-13 shows the estimated percentage of mid- and late-successional hemlock and white pine forests on the Sumter National Forest.

Table 3-13. Estimated percentage of mid- and late-successional hemlock and white pine forests on the Sumter National Forest (mountains only), after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

Alternative	Yr10	Yr50
Alternative A	6.5	6.4
Alternative B	5.3	5.7
Alternative D	6.7	5.5
Alternative E	5.8	6.8
Alternative F	6.8	3.6
Alternative G	6.2	7.7
Alternative I	6.1	6.8

Eastern hemlock forests are naturally limited in distribution, occurring primarily in association with north facing coves and slopes and in riparian areas. Under all alternatives, forestwide standards are included that defer existing hemlock forests from

regeneration cutting during this plan period and maintains the hemlock component where it occurs as patches within other forest types. These provisions are included under all alternatives in an effort to maintain mature hemlock forests in the face of threats to this type from the hemlock woolly adelgid. As a result of these provisions, no changes to the distribution and abundance of eastern hemlock forest are anticipated as a direct or indirect effect of national forest management. However, long-term effects from the hemlock woolly adelgid may be large (see cumulative effects).

Objectives to restore white pine plantations to more diverse natural communities would benefit species dependant upon multi-layered canopies with an evergreen component. Because hemlock forests would not be subject to regeneration cutting this planning period, hemlock forests would move into older age classes with plan implementation, increasing abundance of mature forests of this type under all alternatives. Activities within hemlock stands would be limited under all alternatives and would promote mature forests with the desired multi-layered canopy condition that is needed by many species of wildlife.

Because hemlock and white pine forests would be managed to optimize their natural distribution, abundance, and condition in all plan alternatives, potential effects through plan implementation to these vegetative communities should be positive. There are 26 species of plants and animals with viability concerns that are associated with hemlock forests (Appendix F). The positive direct and indirect effects to hemlock and white pine forest communities should contribute to the viability of these associated species under all alternatives. Because provisions for maintenance of hemlock are similar across all alternatives, the magnitude of these positive effects would be similar for all alternatives.

Cumulative Effects

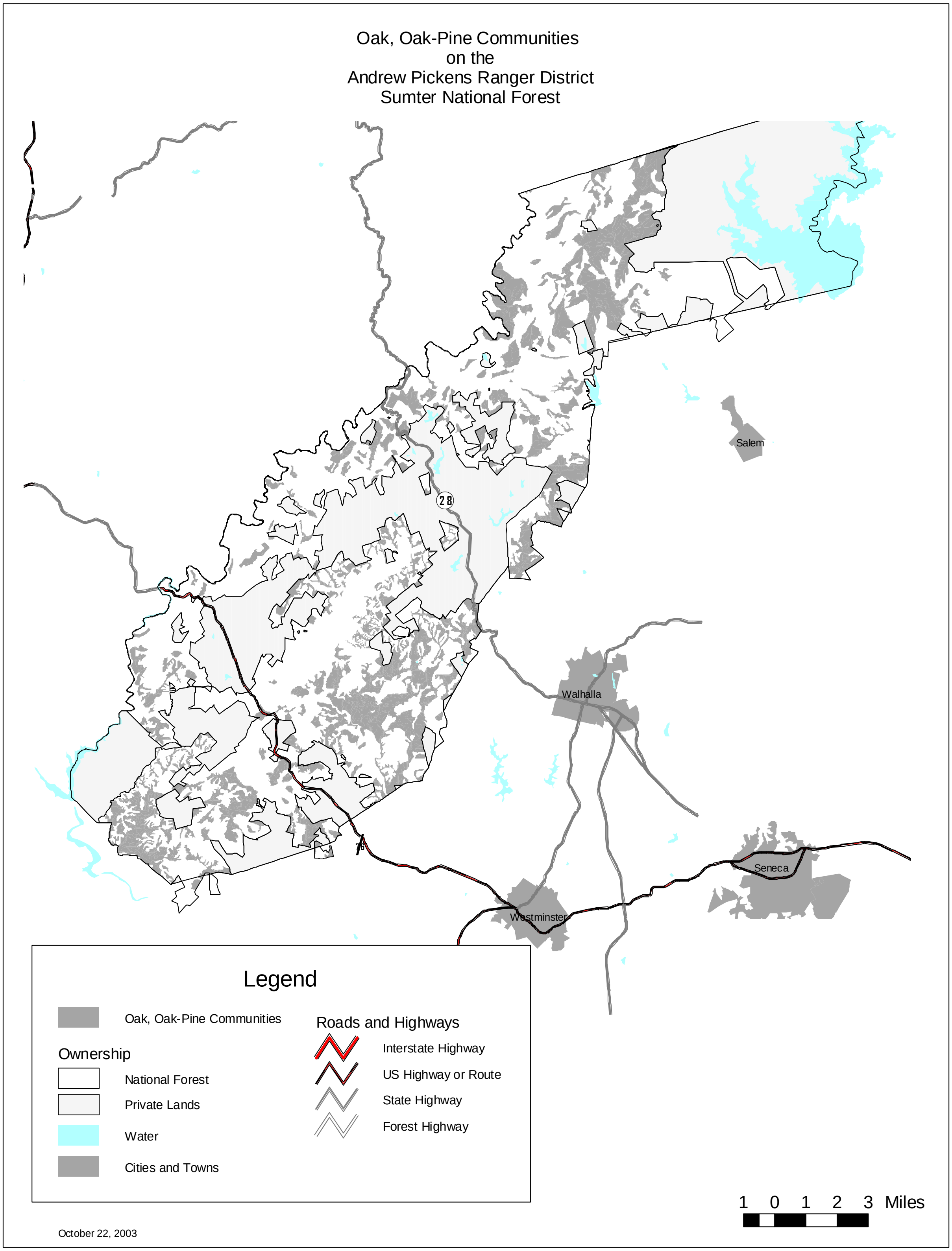
A 39% increase in the acreage of white pine-hemlock forests has been documented across both public and private ownerships in the Southern Appalachians since the mid 1970s (SAMAB 1996). This is largely attributable to an increase in managed stands of white pine (plantations) and upland encroachment of both white pine and hemlock into areas where it would not occur under a natural fire regime. The use of prescribed fire in the restoration of upland habitats will likely shrink these communities back to a more natural distribution on the landscape over time. Despite plan protection and restoration objectives, the current amount and distribution of mature eastern hemlock forests is threatened by the recent emergence of the hemlock woolly adelgid in the Southern Appalachians. The fact that this community type is naturally limited in distribution, coupled with the impending threats from the hemlock woolly adelgid which will imapct the species regardless of land ownership, leaves the long-term maintenance of historical distribution and abundance of this community type in question. The fate of associated viability concern species will be dependent upon their ability to adapt to changing environmental conditions associated with the decline of hemlock from within these communities. Species that utilize hemlock forests in addition to other vegetative

community types will be more likely to persist than species that are obligates to the hemlock forest community.

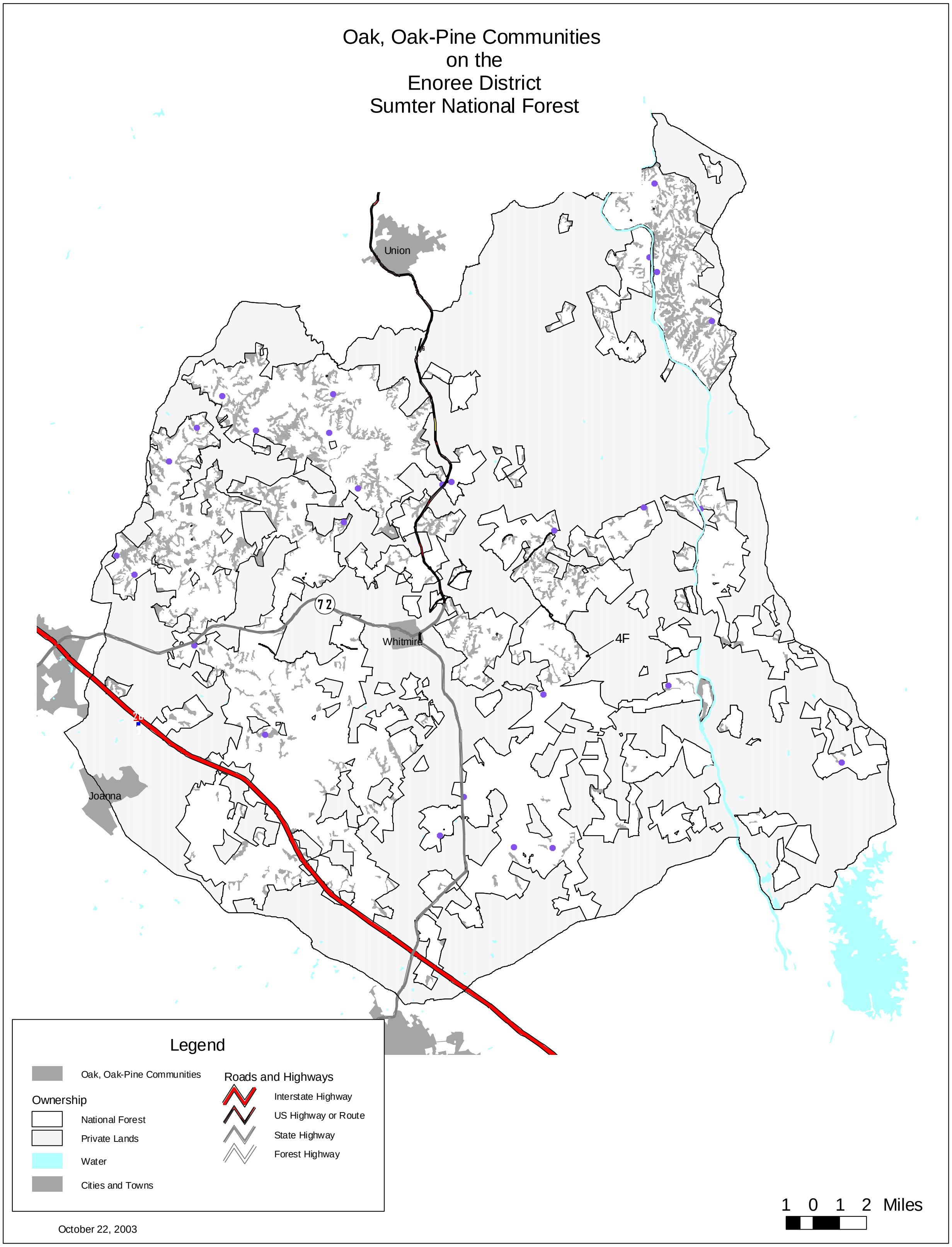
Oak and Oak-Pine Forests

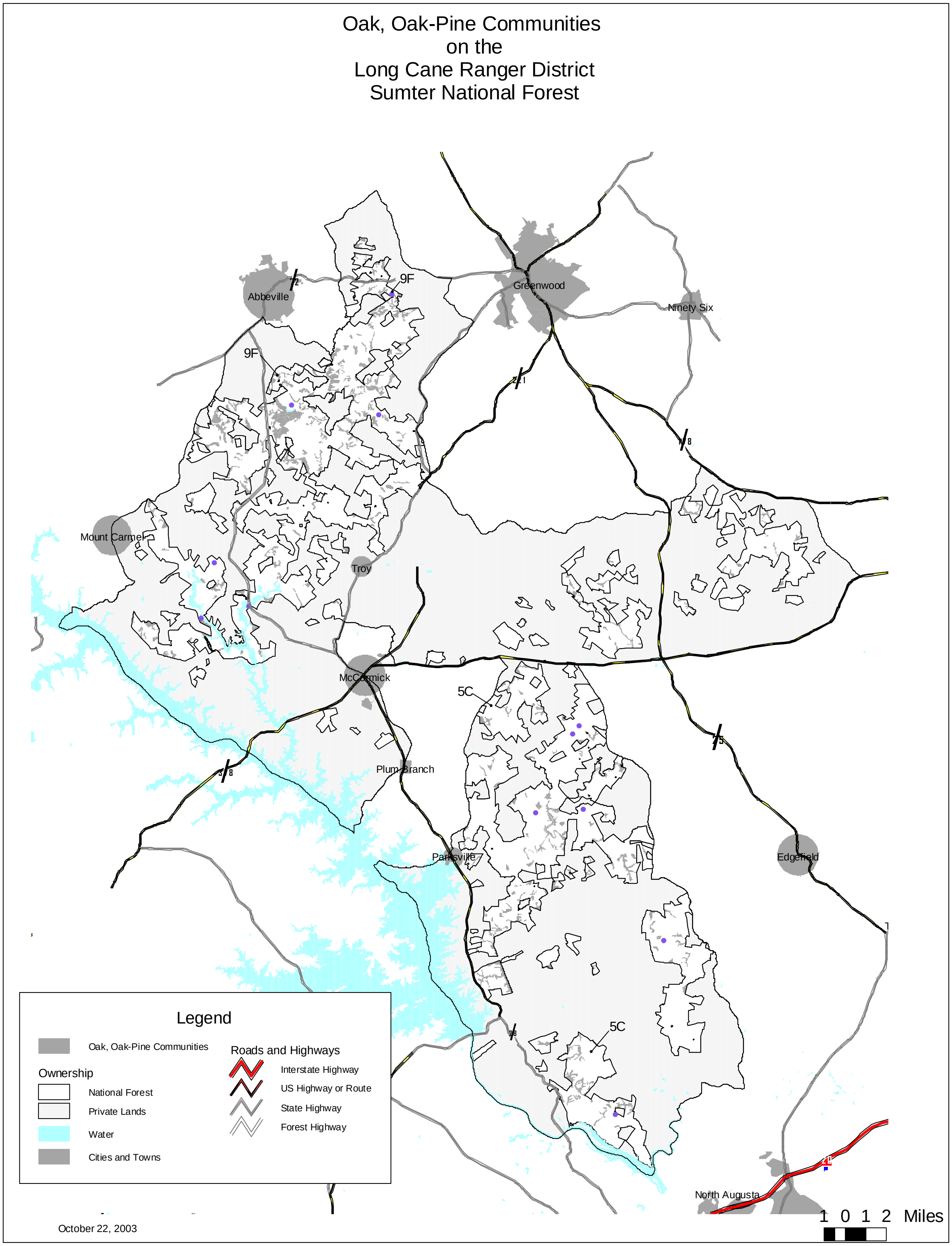
Affected Environment

Oak dominated forests covered under this section include dry to mesic oak and oak-pine forests. Dry-mesic oak forests vary greatly in their species composition due to its wide distribution. The major species include chestnut oak (*Quercus montana*), northern red oak (*Q. rubra*), black oak (*Q. velutina*), white oak (*Q. alba*), and scarlet oak (*Q. coccinea*) (USDA Forest Service 1997:60). The dry to mesic oak-pine forests considered here are oak-dominated forests containing a significant pine component. Predominant pine species include white pine (*Pinus strobus*), shortleaf pine (*P. echinata*), Virginia pine (*P. virginiana*), and loblolly pine (*P. taeda*). These dry to mesic types are distinguished from oak and oak-pine woodlands and savannas, which are targeted at xeric oak, oak-pine, and pine-oak types. These xeric types are covered under the section on "Oak, Mixed, and Pine Woodlands, Savannas, and Grasslands."



Oak, Oak-Pine Communities
on the
Andrew Pickens Ranger District
Sumter National Forest
28
Salem
Walhalla
Seneca
Westminster
Legend
Oak, Oak-Pine Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 3 Miles
October 22, 2003


Oak, Oak-Pine Communities
on the
Enoree District
Sumter National Forest
Union
72
Whitmire
4F
Joanna
Legend
Oak, Oak-Pine Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003


Oak, Oak-Pine Communities
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
9F
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
5C
Plum Branch
Parksville
Edgefield
North Augusta
Legend
Oak, Oak-Pine Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003

Abundance

In the southern United States, acres of oak-hickory and oak-pine forests have increased over the last 50 years. (USDA Forest Service 2001: 49). Oak and oak-pine forests are common throughout the South, comprising over half of the timberland of the region as a whole (USDA Forest Service 2001: 91-92). Oak-hickory forests are the dominant forest type in the Southern Appalachian Ecoregion, and are codominant with loblolly-shortleaf pine forests in the Piedmont Ecoregion. Southern yellow pine forest types dominate the Coastal Plain Ecoregion, but oak and oak-pine forests still comprise nearly 30% of the timberland in this ecoregion.

The current acreage of oak forests for the Sumter National Forest is shown in Table 3-14. Oak forests are abundant and well distributed on the Andrew Pickens District in the mountains. Oak forests are less common on the piedmont districts and are found primarily on lower slopes, in drains, and sporadically on upland sites.

Table 3-14. Current acreage (m acres) and percent of oak[1] forest by successional class, the percent of total oak forest acreage in mid- and late-successional stages, and the percent of total forest acres in mid- to late-successional oak forests for the Sumter National Forest, 2002.

Sumter National Forest

	Mountains	Piedmont
Early Successional	0.2 (0.7%)	0.1 (0.1%)
Sapling/Pole	1.2(4.8%)	1.1 (3.3%)
Mid- Successional	5.3 (21%)	18.4 (57%)
Late-Successional (including Old Growth)	19 (74%)	12.5 (39%)
Total	25.7	32.1
Total acres of M-L Succ. Oak	24.3	30.9
% of total oak acres acres in mid- and late-successional oak forests	94%	96%
% of total forested acres in mid- and late-successional oak forests	29%	11%

1 – dry-mesic oak and oak-pine based on old growth type definitions used in SPECTRUM

The abundance of these forests in the future will be primarily dependant on the management of existing oak stands to maintain oak dominance, restoring oak forests on appropriate sites, and increasing the oak component in mixed (pine/hardwood) stands.

Age Class Distribution

Across the southern United States, about 50% of upland hardwood forests (predominantly oak-hickory) and 30% of natural oak-pine forests are in mid- and late-successional stages (41-plus years-of-age) (USDA Forest Service 2001: 69-70). However, only about 1% of planted oak-pine forests are in mid- and late-successional stages. Approximately 75% of oak-hickory forests are in mid- and late-successional stages (SAMAB 1996: 165) for the Southern Appalachian Assessment Area (includes only the Andrew Pickens District on the Sumter).

The current age class distribution of oak forests for the Sumter National Forest is also shown in Table 3-14. In both the mountains and piedmont, oak forests are heavily weighted towards older age classes. The potential for increases in oak decline and less reliable mast crops is predictable for the mountains in the foreseeable future.

Forest Structure

The structural condition of oak forests is a key factor in the maintenance of these communities. Brose et. al. (2001) describe an emerging hypothesis that periodic, low-intensity surface fires were crucial to the perpetuation of mixed oak forests for millennia. Research indicates that oak forests may not perpetuate themselves without some level of disturbance, especially on mesic sites (Loftis 1991). Treatments such as shelterwood harvest combined with prescribed burning (Brose et. al. 1999) or basal area reduction from below using herbicides (Loftis 1991) have been shown to create conditions that promote adequate oak regeneration. Oak dominance can be maintained by maintaining suitable tree densities and moderate fire return intervals.

Treatments such as moderate thinning and prescribed burning also can be used to create the desired habitat conditions in closed canopy oak forests. There are a number of viability concern species that are associated with open canopy condition and moderate levels of prescribed burning in dry to mesic oak forests (Appendix F).

Mast Production

Mid- and late-successional oak forests provide an important source of hard mast and dens. Acorns are a critical fall and winter food for numerous wildlife species (Martin et. al. 1951). The availability of acorns has been shown to strongly influence population dynamics of species such as black bear (Pelton 1989), squirrels (Nixon et. al. 1975), white-tailed deer (Wentworth et. al. 1992), and white-footed mice (Wolff 1996). The large diameter hollow trees and snags found in these older oak forests also are an important source of dens for black bears (Carlock et. al. 1983). Hard mast production is an important habitat feature for several wildlife species in demand for sport hunting. These include white-tailed deer, wild turkey, squirrels, and bear. There are no mast dependent viability concern species identified for the Sumter National Forest.

Management Indicators

Several management indicators have been identified for assessing effects to oak and oak-pine forest communities. These indicators include both management indicator species (MIS) and key habitat variables.

Four key variables for tracking management effects on this community type are selected. To indicate the level of management activity directed at maintaining this forest type, acres of the type burned annually and acres thinned annually are projected. Restoration efforts are tracked by the annual acreage of oak and oak-pine forest restored to appropriate sites currently occupied by other forest types. Because older oak forests are an important source of oak mast and dens, total acres of mid- and late-successional oak and oak-pine forests are also projected. The scarlet tanager (*Piranga olivacea*) is selected as the wildlife management indicator species for this forest community. Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Direct and Indirect Effects

Abundance

The future abundance of oak and oak-pine forests is primarily related to the maintenance of stand conditions that ensure oak dominance, and to the restoration of oaks or oak-pine forests on appropriate sites currently occupied by pine plantations or other hardwood species such as gum and maple. Expected activity levels related to the maintenance and restoration of oak forests for all alternatives are shown in Tables 3-15 and 3-16, respectively, for the Sumter National Forest. Alternatives B, E, and I have the greatest potential for increasing oak in the mountains and the piedmont.

Table 3-15. Expected Activity Levels related to the maintenance and restoration of oak forests for the Sumter mountain district by alternative.

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of oak or oak-pine forests to be restored	.07	.07	.03	.06	0	0	.04
Average annual acres of oak and oak-pine forests to be burned	3.2	6.5	2.9	5.8	2.1	1.7	5.1
Average annual acres of oak and oak-pine forests to be thinned	.06	.07	.06	.08	.08	.08	.07

Table 3-16. Expected Activity Levels related to the maintenance and restoration of oak forests for Sumter piedmont districts by alternative.

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of oak or oak-pine forests to be restored	.1	.3	.3	.2	.1	.1	.2
Average annual acres of oak and oak-pine forests to be burned	1.8	4.2	2.7	5.1	2.3	1.4	3.8
Average annual acres of oak and oak-pine forests to be thinned	.01	.01	0	.01	.01	.05	.01

The ability to meet these activity levels, to manage these forests to ensure adequate oak regeneration, and to provide habitat conditions for species associated with open canopy condition and moderate levels of prescribed burning will vary among alternatives due to the differences in management intensity and emphasis.

Age Class Distribution and Forest Structure

All alternatives (except G) implement a strategy to provide a distribution of forest stages within the oak and oak-pine forest community. Table 3-17 shows the expected

percentage in mid- and late-successional oak forest for each alternative after 10 and 50 years of implementation. While total acres in oak and oak-pine would remain relatively stable in the mountains, restoration activities would add between 1,000 to 3,000 acres of oak and oak-pine forests per decade on the piedmont (Table 3-15).

Table 3-17. Expected percentage of mid- and late-successional oak[1] forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Yr10	Yr50	Yr10	Yr50
Alternative A	26	19	11	4.6
Alternative B	25	20	10	8.7
Alternative D	23	13	11	4.8
Alternative E	27	22	11	8.0
Alternative F	22	8.6	11	3.3
Alternative G	29	30	11	11
Alternative I	27	21	11	7.9

1 – dry-mesic oak and oak-pine based on old growth type definitions used in SPECTRUM

Mast Production

Acorn production is widely recognized to be greatest in mid- and late-successional oak forests.   Annual acorn crops are highly variable, however, and subject to climatic perturbations (i.e., late spring freezes, drought) and insect (gypsy moth, oak borer) or disease (oak decline) attacks. Current conditions (Table 3-14) depict nearly the entire acreage in oak forests on the Sumter to be in the mid- to late-successional stage. This places the oak forests on the Sumter in a vulnerable position for high mortality and mast crop failure similar to the relationship between extensive pine forests and the southern pine beetle. The expected quantity of mid- and late-successional oak forests will vary among alternatives (Table 3-17) as will the potential for oak mast. The potential for mast production will be greatest in Alternatives B, E, G, and I.

Cumulative Effects

Oak and oak-pine forests are common on the Sumter National Forest as well as on adjacent forest industry, non-industrial private, and other public lands. Management opportunities permitted in most alternatives would ensure continued oak dominance on national forest lands. However, the majority of these oak forests are on non-industrial private lands. These lands are the least likely to receive active forest management and therefore the loss of oak dominance is likely to be more problematic in these areas.

Insects and diseases such as gypsy moth and oak decline also are expected to have an overall negative effect on oak forests in the future (SAMAB 1996: 103-108, 114-117). Gypsy moth is expected to reach the mountains of South Carolina by 2020 and many of the older forests already are experiencing oak decline. The greatest impact of oak decline will be immediately behind the advancing front of gypsy moth due to repeated severe defoliations. As existing oak stands grow older, susceptibility to this disease will increase. Although oaks will not be eliminated from affected areas, oak abundance and diversity will be reduced. On both national forest and private lands, the future of oak forests will largely depend on active management such as thinning and burning that encourage oak reproduction to offset the impacts of these insects and diseases. (See further discussion of these threats in the Forest Health section.)

Woodlands, Savannas, and Grasslands

Affected Environment

Complexes of woodlands, savannas, and grasslands were once a frequent occurrence across the southeastern landscape, maintained with frequent fire on xeric ridgetops and south-facing slopes (DeSelm and Murdock, 1993; Davis et.al. 2002). Woodlands are open stands of trees, generally forming 25 to 60% canopy closure (Grossman et.al. 1998:21) and may be of pine, hardwood (typically oak), or mixed composition. Savannas are usually defined as having lower tree densities than woodlands; grasslands are mostly devoid of trees. All of these conditions typically occurred in mixed mosaics within a fire-maintained landscape. In all cases, a well-developed grassy or herbaceous understory is present.

Frost (2002) estimated that 55-70% of the landscape on the Sumter National Forest was once dominated by fire-influenced savannas and woodlands. Existing remnants of this habitat and several associated rare species in both the Southern Appalachians and Piedmont are limited to roadside and power line rights-of-way (Davis et.al. 2002), due to reductions in fire frequency across the landscape. Good examples of this community can be found in areas managed for featured species such as the red-cockaded woodpecker and northern bobwhite quail.

Many species of viability concern are associated with this community in both the Southern Appalachians and the Piedmont (Appendix F). Of these, the majority are vascular plants, followed by reptiles, birds, and insects.

Because existing woodland, savanna, and grassland complexes are rare and not consistently tracked, the current acreage in such condition is not well documented. One method for determining the potential for this community type on the Sumter National Forest is to display the acreage in xeric and dry pine and oak forest communities (Table 3-18). The xeric and dry sites were the most likely to support woodlands, savannas, or grasslands historically.

Table 3-18. Acreage in Xeric and Dry Forest Communities on the Sumter National Forest, 2002.

	Andrew Pickens District	Piedmont District
Dry-xeric oak and pine*	1,700	53,685
Dry-mesic oak-pine and pine-oak	9,960	2,240

*Includes loblolly pine with low site index

Management indicators used to assess management effects to this community are: 1) total acres of woodland, savanna, and grassland complexes restored and maintained in desired conditions; 2) annual acreage of forests thinned for the purpose of restoring desired tree densities; 3) annual acreage of prescribed burning for the purpose of restoring or maintaining open conditions and diverse understories; and 4) populations of management indictor species chosen to represent desired conditions within this type. Management indicator species chosen for this type are field sparrow and northern bobwhite quail.

Population trends for northern bobwhite quail and field sparrow are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Direct and Indirect Effects

Because of their current rarity, existing remnants of woodland communities that support significant populations or assemblages of rare species would be managed under the Rare community prescription under all alternatives. Similarly, existing woodland conditions associated with glades and barrens also would be included under rare community provisions. The Rare community prescription provides priority to protection and maintenance of such sites under all alternatives, including regular prescribed burning to maintain desired species composition and vegetation structure. Therefore, these sites are expected to be sustained for the foreseeable future under all alternatives.

In an effort to restore some of the ecological role that these communities have historically played, Alternatives A, B, D, E, and I develop areas of woodland savanna habitats. The draft revised plan (Alternative I) includes objectives for restoring complexes of woodlands, savannas, and grasslands to fire-maintained landscapes on 8,080 acres in the short-term and 49,460 acres in the long-term. Focus of management is on developing understory plant communities rather than the overstory. Desired conditions include heterogeneous canopy coverage averaging 25 to 60%, and dense grass and herbaceous ground layers. Scattered patches may be devoid of canopy to provide for interspersed savanna and grassland conditions. Restoration activities may include thinning of trees (generally to less than 60 $ft.^2$ of basal area per acre), prescribed burning, and/or herbicide use. Prescribed fire on relatively short rotations (1 to 3 years) typically would be used to maintain desired conditions, and may involve both dormant and growing season burns.

Acres of woodland, savanna, and grassland complex restored and maintained are predicted for the Sumter National Forest, based on the allocation of management prescriptions and desired conditions across alternatives. This analysis suggests that woodland development will occur across all alternatives to some degree, with the lowest amounts in Alternatives F and G (Tables 3-19 and 3-20).

Table 3-19. Expected acres for achieving woodland, savanna, and grassland complexes on the Andrew Pickens District of the Sumter National Forest

Activity	**Alt A**	**Alt B**	**Alt D**	**Alt E**	**Alt F**	**Alt G**	**Alt I**
Total acres 10 years	**1,800**	**3,400**	**1,700**	**5,700**	**700**	**900**	**2,200**
Total acres in 50 years	**5,100**	**6,000**	**2,500**	**13,700**	**1,400**	**3,400**	**7,600**

Table 3-20. Expected acres and activities for achieving woodland, savanna, and grasslands complexes on the Piedmont Districts of the Sumter National Forest

Activity	**Alt A**	**Alt B**	**Alt D**	**Alt E**	**Alt F**	**Alt G**	**Alt I**
Total acres in 10 years	**5,400**	**10,300**	**5,100**	**17,000**	**2,100**	**2,800**	**5,200**
Total acres in 50 years	**20,400**	**24,200**	**10,000**	**54,800**	**5,600**	**13,600**	**17,400**

Because good examples of this community have become rare or missing on today's landscape, abundance of this community type in the future will be directly related to the amount of restoration and maintenance activities accomplished. Restoration and maintenance activities will provide habitat for species included within this habitat association, including the bobwhite quail, Bachman's sparrow, little bluestem, and smooth coneflower. Populations of these species, with the exception of smooth coneflower, are expected to vary across alternatives based on the amount of woodland savanna habitat restored and maintained.

Restoration and maintenance activities may cause some short-term negative effects to individual MIS, with the exception of smooth coneflower, by causing disturbance, mortality, or temporary set back of plant and animal reproduction or growth. However, species associated with this community are relatively adapted to such disturbances, which are necessary to create and maintain optimal habitat conditions. In balance, these actions would result in beneficial effects to associated species.

Cumulative Effects

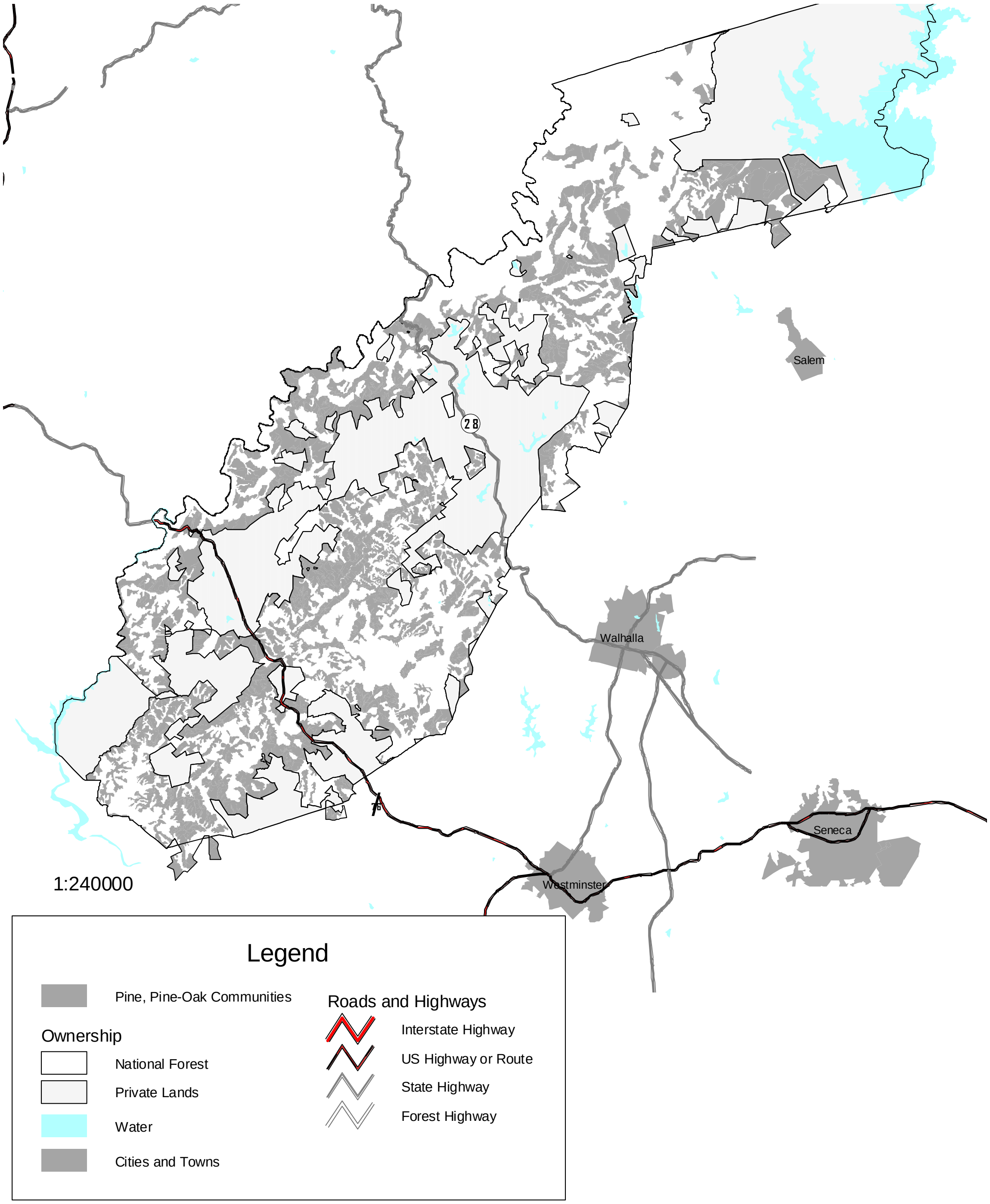
Restoration and management activities on national forests would play a critical role in the conservation of this community within the landscapes containing national forest land. Natural woodland, savanna, and grassland habitats are currently rare, occurring on private ownerships primarily along mowed roadside and power line rights-of-ways (Davis et.al. 2002). It is not expected that private landowners will restore or manage to maintain significant amounts of woodland, savanna, and grassland complexes; therefore, they would remain limited in abundance without national forest restoration efforts.

Pine and Pine-Oak Forests

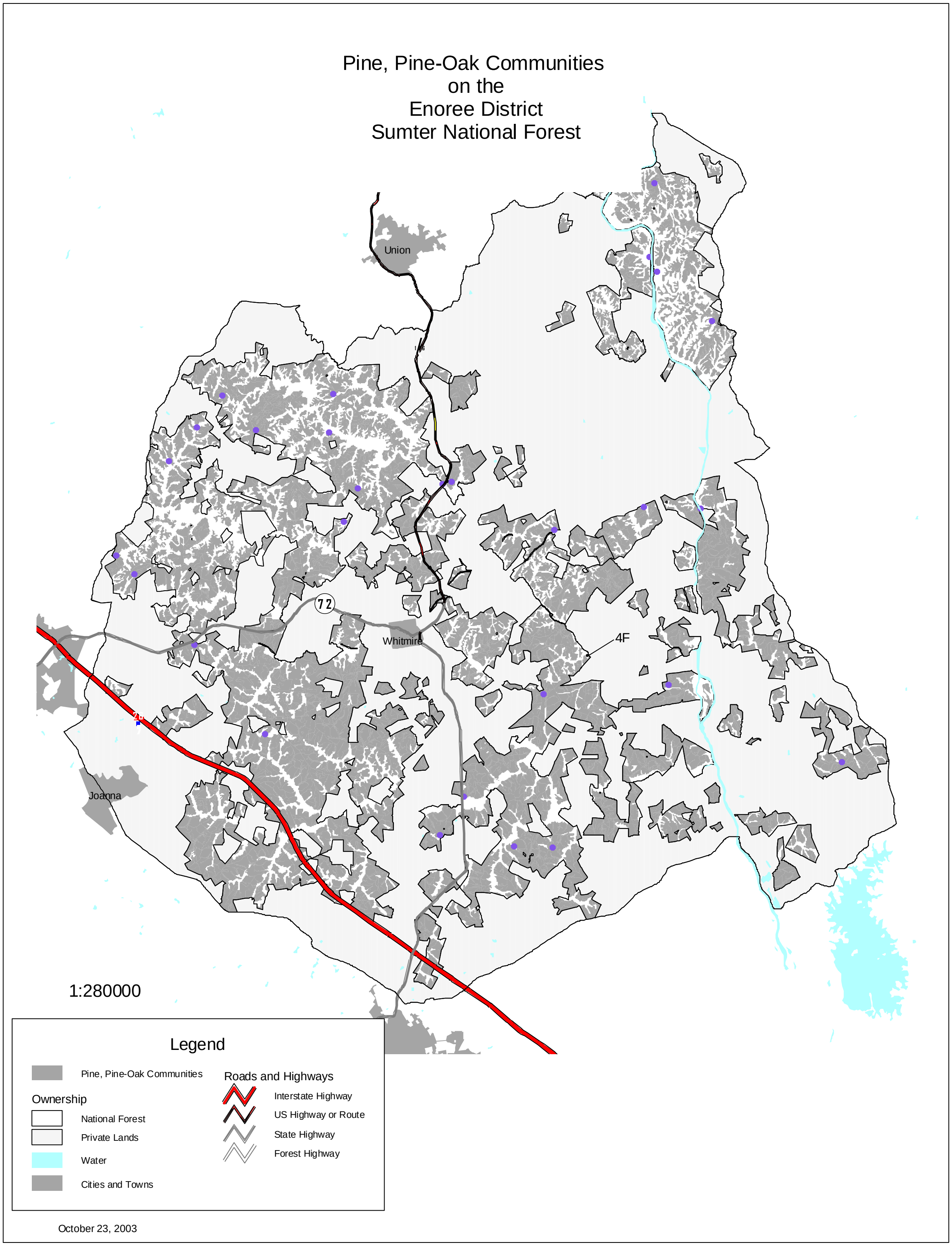
Affected Environment

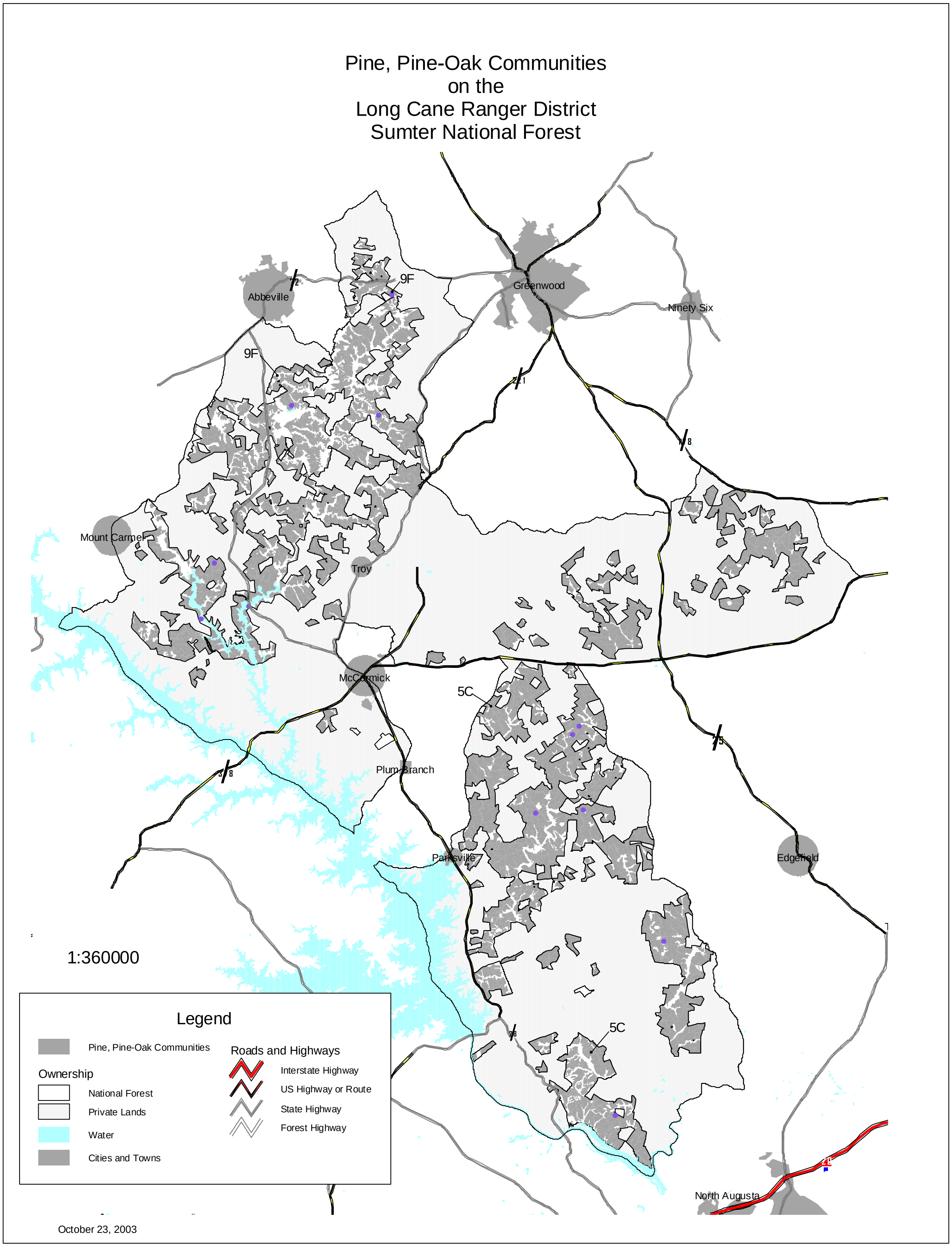
Pine dominated forests covered in this section include all "southern yellow pine" (SAMAB 1996: 163) forest types with various mixtures of hardwood species occurring as minor components. These forests occur on a variety of landforms at a wide range of elevations. Historically, in the Blue Ridge physiographic province, these communities occupied areas that were subject to natural fire regimes and typically occurred on ridges and slopes with southern exposures (NatureServe 2002). However, due to a combination of previous land use, fire exclusion, and intensive forestry (plantations), many pine species have expanded beyond their natural range and today, pine-dominated communities can be found on virtually all landforms and aspects. In the Piedmont, pine and pine-oak forests are common in all topographic locations and often persist as fire-adapted communities on drier sites.

Pine, Pine-Oak Communities
on the
Andrew Pickens Ranger District
Sumter National Forest



October 23, 2003


Pine, Pine-Oak Communities
on the
Enoree District
Sumter National Forest
Union
72
Whitmire
4F
Joanna
1:280000
Legend
Pine, Pine-Oak Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003



Pine, Pine-Oak Communities
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
Greenwood
Ninety Six
9F
Mount Carmel
Troy
McCormick
5C
Plum Branch
Parksville
Edgefield
North Augusta
1:360000
Legend
Pine, Pine-Oak Communities
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
October 23, 2003

Abundance

During the last 50 years across the southeastern United States, pine plantations have increased in importance, expanding from 1% of the total pine forest acres to 48% of those acres (USDA Forest Service 2001: 1). At the same time, the 20-year trend reported for the Southern Appalachian Assessment area (SAMAB 1996: 27) shows a downward trend of 16% for southern yellow pine forests. These two facts together suggest that natural yellow pine forests have declined significantly and represent an opportunity for large-scale restoration of this community type.

The Sumter National Forest has been experiencing a southern pine beetle epidemic since 2001 and currently about 36% of southern yellow pine stands on the forest have been impacted. Historical data suggests that large areas that have become occupied by even aged stands of loblolly pine would have naturally supported mixed pine-hardwood stands of loblolly (on more mesic sites), longleaf (pitch pine in the mountains) on drier sites, and shortleaf pine. These natural communities are maintained by low intensity fires originating on ridgetops and southern exposures (NatureServe 2002). With substantial mortality in existing pine stands due to pine beetle effects, there are some opportunities to restore these sites to a more natural mixed pine-hardwood community.

Age Class Distribution and Forest Structure

On the Sumter National Forest, pine and pine-oak forests are currently well distributed across the landscape (Table 3-21).

Table 3-21. Current acreage (m acres) of pine and pine-oak forests on the Sumter National Forest by physiographic area and successional class.

	Sumter National Forest	
	Mountains	Piedmont
Early Successional	1.5	14.6
Sapling/Pole	5.5	40.8
Mid- Successional	10.3	73
Late-Successional (including Old Growth)	19.8	84.9
Total	37.1	213.3
Total acres of M-L Succ. pine	30.1	157.9
% of total pine, pine-oak acres in mid- and late-successional pine forests	81	74
% of total forested acres in mid- and late-successional pine, pine-oak forests	36	57

The Southern Appalachian Assessment (SAMAB 1996: 165, 168-169) summarizes the age class distribution of pine and pine-oak forests across the Southern Appalachian assessment area by a variety of land ownerships (Table 3-22).

Table 3-22. Successional stage distributions (in %) for pine and pine-oak forests across several ownerships in the Southern Appalachian Assessment Area.

Successional Stage	**Sumter NF (mountains only)**	**All Public Lands**	**All Private Lands**	**All Ownerships**
Early Successional	3.1%	10%	18%	16%
Sapling/Pole	11.7%	9%	19%	18%
Mid- Successional	28.2%	32%	59%	55%
Late-Successional (includes old growth)	57%	49%	4%	11%

National Forest data is derived from the CISC Database. Data for other ownerships is derived from FIA and LANDSAT data

Several species of viability concern are associated with late-successional southern yellow pine forests maintained in open conditions by frequent fire (Appendix F). While public lands support the majority of late-successional acres, the structure and composition of these forests has been altered due to years of fire suppression resulting in less than optimal habitat conditions. Fire intolerant species such as loblolly, Virginia, and white pine have proliferated while other pines (shortleaf, pitch, Table Mountain, longleaf) have seen dramatic declines (NatureServe 2002; Martin et.al. 1993). In the absence of fire, hardwoods, shrubs, and vines have replaced the open, grassy, herbaceous layer that is characteristic of frequently burned areas, and hardwoods have encroached into the midstory further affecting forest structure. This change in forest structure and resulting habitat condition has had a direct effect on species dependent upon these communities. Several bird and reptile species associated with southern pine forests are in decline (Dickson 2001) as various habitat components are lost. In addition to declines in species dependent upon specific habitat attributes, entire pine communities are in decline. Recent studies show that acreage of Table Mountain pine communities (considered a rare community in the Southern Appalachians) has decreased due to fire suppression (Turrill and Buckner 1995) and that many remaining examples have substantial hardwood invasion.

Management Indicators

Several management indicators have been identified for assessing effects to pine and pine-oak forest communities. These indicators include both key habitat variables and management indicator species (MIS).

Key habitat variables to be monitored annually include the number of acres of pine forests burned, the number of acres of pine plantations restored to natural communities, and the total number of acres of pine forests restored. These activities together indicate the level of effort directed at maintaining or restoring pine and pine-oak communities.

The pine warbler (*Dendroica pinus*) and brown headed nuthatch *(Sitta Pusilla)* are selected as wildlife management indicator species for this forest community. Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Direct and Indirect Effects

Abundance

The future distribution of pine and pine-oak forests on the Sumter National Forest will vary among alternatives in relation to management objectives for the maintenance and restoration of these community types. Tables 3-23 (mountains) and 3-24 (piedmont) list the expected activity levels related to maintenance and restoration of southern yellow pine forests by alternative. Table 3-25 shows the expected percentage in acreage of mid- and late-successional pine forests on the Sumter National Forest.

Table 3-23. Expected activity levels related to the maintenance and restoration of pine and pine-oak forests in the mountains on the Sumter National Forest (1st decade)

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of shortleaf pine, pitch pine, or Table Mountain pine forests to be restored.	600	400	500	500	600	400	600
Average annual acres of southern yellow pine to be burned	4,400	7,200	4,100	6,400	3,300	2,200	5,600
Average annual acres of loblolly pine to be thinned	2,000	2,200	1,000	2,000	0	0	1,200
Average annual acres of loblolly pine forests to be converted through restoration of fire adapted pine or pine oak communities.	400	600	400	400	0	200	400

Table 3-24. Expected activity levels related to the maintenance and restoration of pine and pine-oak forests in the piedmont on the Sumter National Forest (1st decade)

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of shortleaf pine, to be restored.	200	300	400	300	0	100	300
Average annual acres of southern yellow pine to be burned	12,500	19,700	12,700	18,900	12,200	6,200	13,000
Average annual acres of loblolly pine to be thinned	7,700	29,200	18,300	16,900	28,400	18,600	19,400
Average annual acres of loblolly pine forests to be converted through restoration of fire adapted pine or pine oak communities.	500	1,000	1,100	800	0	300	800

Table 3-25. Expected percentage of mid- and late-successional pine and pine-oak forests on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Yr10	Yr50	Yr10	Yr50
Alternative A	36	35	44	49
Alternative B	35	35	54	58
Alternative D	35	28	47	52
Alternative E	36	35	49	58
Alternative F	35	25	43	50
Alternative G	35	42	52	59
Alternative I	27	25	49	49

Age Class Distribution and Forest Structure

Future age class distributions and forest structure will vary among alternatives due to the differences in management intensity and emphasis. The ability to use fire as a management tool will play a critical part in restoring natural species assemblages and forest structure within pine and pine-oak communities

As shown in Tables 3-23 and 3-24, opportunities exist to manipulate vegetation in southern yellow pine forests through prescribed fire and other vegetation management techniques under all alternatives. Projected activities should be sufficient to enhance existing habitat conditions within pine and pine-oak forests above their current levels. Longer rotation ages coupled with more frequent fire will enhance habitat attributes such

as grassy understories and standing snags needed by several declining bird species (Dickson 2001). Analysis indicates that, under all alternatives, in 50 years this habitat element will be abundant and well distributed across the forest.

Cumulative Effects

Pine and pine-oak forests are common on the Sumter National Forest as well as on adjacent private and public lands. The distribution of age classes (Table 3-22) as well as composition and structure within stands varies considerably based upon ownership, with the majority of older pine forests and diversity of forest types occurring on public lands. Management opportunities under all alternatives will ensure continued persistence of these communities on national forest lands with a focus on maintenance and restoration of natural species assemblages. Public lands already provide a vital function in providing the bulk of mid- and late-successional southern yellow pine forests and as restoration proceeds within these communities on national forest lands, the importance of these habitats to species of regional viability concern will increase.

Brown headed nuthatch populations are expected to respond to increases in open canopies of mid to late successional pine and pine-oak communities where dominance in different canopy levels is shared by deciduous and coniferous species. Pine warbler populations are expected to respond to mid to late successional pine and pine-oak that is dominated by conifers with a predominately closed canopy.

Rare Communities

Glades, Barrens, and Associated Woodlands

Affected Environment

These communities are characterized by thin soils and exposed parent material that result in localized complexes of bare soils and rock, herbaceous and/or shrubby vegetation, and thin, often stunted woods. During wet periods they may include scattered shallow pools or areas of seepage. Glades, barrens, and associated woodlands differ from rock outcrop communities by exhibiting soils and vegetative cover over the majority of the site, and differ from the more widespread woodland communities in that they occur on geologic substrates which are unique for the region, including limestone, dolomite, amphibolite, greenstone, mafic rock, serpentine, sandstone, or shale. Associated communities include calcareous woodlands and glades, mafic woodlands and glades, serpentine woodlands and glades, and shale barrens as defined in the Southern Appalachian Assessment (SAMAB 1996). This rare community complex includes rare associations within the following ecological groups as defined by NatureServe (2001a):

401-12	Appalachian Highlands Unstable Substrate Woodlands
401-13	Appalachian Highlands Dry and Mesic Oak Forests and Woodlands
401-17	Appalachian Highlands Calcareous/Circumneutral Dry-Mesic Hardwood Forest
440-05	Appalachian Highlands Carbonate Glades and Barrens
440-10	Interior Highlands Carbonate Glades and Barrens
440-25	Appalachian Sandstone Glades and Barrens
440-65	Appalachian Serpentine Woodlands
440-80	Appalachian Mafic Igneous/Metamorphic Glades and Barrens
xxx-xx	Applachian Highlands Unstable Substrate Woodlands

These communities may be found in the Appalachian and Piedmont regions. Limestone or dolomite, and sandstone glades and barrens occur primarily in the Ridge and Valley physiographic provinces ranging from Northern Alabama to Kentucky. Good examples are few and very restricted in distribution. Serpentine glades are known primarily from the Nantahala National Forest in North Carolina. Shale and mafic woodlands are more widespread in distribution, and may be forested if fire has not played a role in their maintenance or restoration. Most occurrences for mafic associations are from the piedmont, but may occur as high as 3800 feet in elevation. Most shale woodlands are in the Carolina slate belt in Georgia, North Carolina, and South Carolina, but neither shale nor mafic woodlands have been well inventoried.

The SAA (1996) concluded that only 25% of the known occurrences for species associated with mafic and other calcareous habitats occurred on national forest lands. Occurrence data for these communities on national forest land is limited On the Sumter National Forest, approximately 800 acres occur on the Andrew Pickens and 400 acres on the piedmont district. Numbers of species of concern associated with rare glades,

barrens, and woodlands include approximately 17 species on the piedmont and 110 species in the Southern Appalachians. The majority are vascular plants (88% and 91% in piedmont and Southern Appalachians, respectively) followed by insects and reptiles.

Although rare communities will be protected or restored across all alternatives, the following management and restoration issues are specific to glades, barrens, and associated woodlands. Though underlying soils may differ from the surrounding soils in exchangeable nutrient capacity or pH, they may be overlooked in mapping efforts since they often occur as inclusions within 10-acre stands.

- Lack of inventory information.
- Woodland communities will likely require active restoration, such as basal area reduction (<60ft.^{2}), woody understory and mid-story control, or prescribed fire. Frequent prescribed fire (every 2-3 years) will be needed to maintain these communities once restored.
- Fire occurred only periodically (every 7-12 years) in glade communities, which occur on shallow soils and under rockier conditions.

Direct and Indirect Effects

Many rare communities of this type are likely to be overgrown or in need of some level of restoration. Slightly adverse short-term effects could occur as a result of active restoration activities, which may temporarily alter the timing of reproduction or growth, but will result in no long-term adverse effects. Short-term direct effects to species associated with these communities are likely to be small and significant compared to the positive indirect benefits of habitat restoration activities, when needed. Since all rare communities will be managed under the rare community (9F) prescription, and the standards associated with the rare community prescription will be applied, effects of national forest management on both the communities and associated species is expected to be positive across all alternatives in the long-term.

Since community inventories will primarily be conducted in project areas, consistent with the standard specific to this prescription, alternatives with fewer anticipated projects may result in the discovery and consequent restoration of fewer rare communities. Although the glade and barren communities are geographically restricted in distribution, and require low intensity disturbance once they are restored, they will be managed or restored to maintain their characteristics based on forestwide goals for rare communities which will be applied across all alternatives. Analysis suggests that on the Sumter National Forest, the glade, barren, and woodland rare communities will be well-distributed (to the extent that their distribution allows it) across all alternatives, but as a result of more extensive inventories, these communities will be better distributed in year 50 compared to year 10 of plan implementation.

Cumulative Effects

The cumulative effects on the quantity and distribution of these rare communities is predicted by considering opportunities to inventory and restore these communities across alternatives and across private and public ownerships. Our ability to protect and restore these communities on the national forest is limited by our knowledge regarding their occurrence and distribution on the landscape. If only 25% of the known sites for this community type occur on national forest land, glades, barrens, and woodland rare communities are likely to be vulnerable to development, competition with successional vegetation, and possible extirpation. Given the emphasis on rare communities in this forest plan, our knowledge regarding their distribution on national forest land is likely to increase. This suggests that national forests will play a larger role than private land in the conservation of glade, savanna, and woodland rare communities in the future. The cumulative effects of plan implementation are likely to be positive, though more so in year 50 compared to year 10 of plan implementation as a result of better inventories.

Basic Mesic Forests

Affected Environment

These communities are characterized by closed-canopy deciduous overstories and rich and diverse understories of calciphilic herbs, underlain by high-base geologic substrates. On moderate to high elevation sites, these communities are typically found in protected coves, and can be distinguished from more acidic mesic cove forests by the abundance of species such as white basswood (*Tilia americana*), yellow buckeye (*Aesculus flava*), black walnut (*Juglans nigra*), faded trillium (*Trillium discolor*), sweet white trillium (*Trillium simile*), black cohosh (*Cimicifuga racemosa*), blue cohosh (*Caulophyllum thalictroides*), whorled horsebalm (*Collinsonia verticillata*), mock orange (*Philadelphus inodorus*), sweet shrub (*Calycanthus floridus*), sweet cicely (*Ozmorhiza* spp.), doll's eyes (*Actaea racemosa*), maidenhair fern (*Adiantum pedatum*), and plantain-leaved sedge (*Carex plantaginea*). Good examples of moderate and high elevation basic mesic forests have a low incidence of white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), rhododendron (*Rhododendron* spp.), and Christmas fern (*Polystichum acrostichoides*).

On lower elevation sites, these communities are more typically found on north slopes, where dominant and characteristic overstory species are American beech (*Fagus grandifolia*) and northern red oak (*Quercus rubra*), with tulip poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), or white ash (Fraxinus *americana*), with southern sugar maple, chalk maple, painted buckeye (*Aesculus sylvatica*), and pawpaw (*Asimina triloba*) in the midstory and shrub layers, and understories that include faded trillium, nodding trillium(*Trillium rugelii*), black cohosh, doll's eyes, foam flower (*Tiarella cordifolia var. collina*), bloodroot (*Sanguinaria canadensis*), bellworts (*Uvularia sp.*) and trout lilies (*Erythronium spp.)*. Good examples of low elevation basic mesic forests have a low incidence of sweetgum (*Liquidambar*

styraciflua), loblolly pine (*Pinus taeda*), and non-natives such as Japanese honeysuckle (*Lonicera japonica*) or Chinese privet (*Lingustrum vulgare*).

Basic mesic forest communities are found in both the Appalachian and Piedmont regions. This community includes the following associations defined by NatureServe (2001a, 2001b):

CEGL007711	Southern Appalachian Cove Forest (Rich Foothills Type),
CEGL007695	Southern Appalachian Cove Forest (Rich Montane Type),
CEGL008442	Shumard Oak-Chinquapin Oak Mesic Limestone Forest
CEGL008466	Basic Piedmont Mesic Mixed Hardwood Forest
CEGL008488	Southern Ridge and Valley Basic Mesic Hardwood Forest
CEGL004542	Piedmont Rocky Mesic Mafic Forest.

The Southern Appalachian Assessment (SAMAB 1996:49) combined mesic and xeric mafic communities, and concluded that only 25% of the known occurrences for species associated with mafic and other calcareous habitats occurred on national forest land. Several species of viability concern are associated with basic mesic forests, with the majority being vascular plants (Appendix F). Identification of these communities is typically based on site-specific inventories. On the Sumter National Forest, the shumard oak-chinquaqin oak mesic limestone forest and the southern ridge and valley basic mesic hardwood forests are not likely to occur here since South Carolina is outside of the range for this community type. At least 10 rare basic mesic community occurrences are known from the Sumter, including seven on the Andrew Pickens Ranger District, three on the Long Cane Ranger District, and two on the Enoree Ranger District, but more are possible. Occurrences on the Andrew Pickens occur primarily along the Brevard geologic escarpment.

Direct and Indirect Effects

All high quality basic mesic forest communities will be managed under the 9F (rare community) prescription under all alternatives. Primary management needs are protection from undesirable disturbance. These communities are characterized by low intensity, low frequency disturbances, and are often most threatened by recreational use, since many are desirable for interpretive trails. Several standards for rare communities ensure their maintenance or restoration across the forest. The 9F prescription encourages the exclusion of basic mesic forests from prescribed burning blocks where this can be accomplished without large increases in fire line construction, and discourages direct firing unless necessary to secure control lines. Only low intensity fires are allowed. Alternative E, which emphasizes recreation, may present the greatest management challenge to protection of these communities and associated species. Additional rare communities standards are designed to reduce or eliminate adverse effects to rare communities caused by recreational use.

Since rare communities would be protected or restored across all alternatives, the effects of national forest management on these communities and associated species would be positive under all alternatives. However, under all alternatives this community will remain relatively rare on the forest because of its naturally limited distribution.

Cumulative Effects

The cumulative effect on the quantity and distribution of basic mesic forests is determined by considering trends in the status of these communities through time and across private and public ownerships. Even though people increasingly use the national forest for recreational or social needs, protection actions will have positive effects. However, based on regional conditions reported in SAMAB (1996: 49) the Sumter National Forest likely contains a relatively small proportion of known occurrences of this community type; examples of the type on private lands are unlikely to receive the same level of protection. It is expected that the cumulative effects of development, recreational use, timber harvest, and other activities on private lands will result in a decrease of good examples of these community types across the landscape, making national forest examples increasingly valuable to regional conservation.

Canebrake Communities

Affected Environment

Although at the time of European settlement canebrakes were common in the southeast, they rapidly disappeared following settlement due to factors such as overgrazing, clearing of land for farming, altered burning regimes, and changes in floodplain hydrology (Brantley and Platt 2001). Faunal surveys in canebrakes are quite limited and canebrake ecology has been largely ignored by contemporary workers (Platt and Brantley 1997). At least six species of butterfly may be canebrake obligates (Scott 1986; Opler and Malikul 1992), and 5 of the 6 are thought to be declining due to destruction of cane habitat (Opler and Malikul 1992). In the Coastal Plain and Piedmont, canebrakes also provide habitat for nesting Swainson's warbler (*Limnothlypis swainsonii*), a bird that is threatened by destruction of this habitat (Hamel 1992; Brown and Dickson 1994). Large canebrakes are extremely rare today, and therefore it is critical to maintain these communities where they occur on Forest Service land.

Canebrakes are characterized by almost monotypic stands of giant or switch cane (*Arundinaria gigantea*), usually with no-or-low densities of overstory tree canopy. They are typically found in bottomlands or stream terraces. This community is found in the Appalachian, Piedmont, and Coastal Plain regions. Primary management needs are restoration and maintenance through overstory reduction and periodic prescribed fire. Although several associations described by NatureServe (2001) include cane as a major component, this community most closely corresponds to:

CEGL003836 Floodplain Canebrake.

The Sumter NF has approximately 16,800 acres of cane communities with potential for restoration, based on 25% of the acreage in riparian corridor. Giant cane is commonly found scattered throughout the understory of forested bottomland forests on alluvial soils in the piedmont, and on side-slopes throughout the Andrew Pickens district, particularly at lower (less than 1500 feet) elevations. Bottomland terraces most commonly associated with canebrakes occur primarily on the piedmont ranger districts.

Several viability concern species are associated with canebrakes (Appendix F). There are 16 species listed as viability concern species for the Southern Appalachian ecoregion. Four viability concern species are listed for the Piedmont ecoregion.

Direct and Indirect Effects

Although cane is found commonly as an understory component in bottomlands and stream terraces, provisions of the rare community prescription would apply only to larger patches (generally greater than 0.25 acres) exhibiting high densities that result in nearly monotypic conditions, or to areas selected for restoration of such conditions. All existing canebrake communities meeting this definition would be managed under all alternatives for protection and maintenance. Restoration objectives are defined for the draft forest plan (Alternative I) and would vary by alternative (Table 3-26). Canebrakes generally fall within riparian corridors and therefore also would be subject to riparian prescription provisions.

Direct effects would be those of management activities conducted to restore and maintain the canebrakes. These management options would include prescribed burning and/or herbicide treatment to control competing herbaceous and woody vegetation and restore culm vigor, and overstory and midstory removal to restore declining stands of cane.

By conducting prescribed burns on a 7 to 10 year interval, impacts to the canebrake should be beneficial, since more frequent fires eventually result in death of the plants (Platt and Brantley 1997). Prescribed burning would be carried out following standards and guidelines for prescribed fire, including prohibition of fire line construction in rare communities. Overstory and midstory removal, where needed for restoration, would be conducted under the standards and guidelines developed for rare communities, thus preventing direct adverse effects to the canebrakes during implementation of the vegetation removal. Restoration, and maintenance actions would result in long-term beneficial effects to the species associated with canebrake communities through improvement of their habitat. Canebrake restoration efforts would occur only on sites currently supporting cane.

Table 3-26. Acres of canebrake restoration expected under Forest Plan alternatives for the Sumter National Forest, Enoree and Long Cane Districts

Objective	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of canebrake restoration	65-330	65-330	65-330	65-330	65	65-330	65-330

Trends in abundance and condition of canebrakes would be positive under all alternatives, except Alternative F (No Action), due to new focus on maintenance and restoration of this community. However, because of relatively low levels of restoration expected under all alternatives coupled with current rarity, canebrake communities are expected to remain rare for the foreseeable future relative to their historical distribution. Higher levels of restoration are not anticipated under any alternatives because other resource considerations receive priority within the riparian areas where most restoration opportunities exist.

Cumulative Effects

Management direction for canebrake communities is similar across revision forests. Because priority is put on these communities, effects of national forest management on them and the associated species is expected to be beneficial under all alternatives except Alternative F. However, this community under all alternatives and in all ecoregions will remain rare relative to its historical distribution, making these habitats on national forest land critical to associated species.

Caves and Mines

Affected Environment

This community is characterized by natural and human-made openings in the ground that extend beyond the zone of light, creating sites buffered in relation to the outside environment. Included are karst and sinkhole features and sinking streams that lead to subterranean environments. Surfaces of karstlands are directly linked to cave water systems and aquifers (Kastning and Kastning 1990).

The shape and location of entrances, along with the hydrology, configuration, size, elevation, and patterns of airflow influence the types of fauna found within caves and mines (SAMAB 1996: 180). Many bats are dependent on caves, both seasonally and year-round. Bats select roosts with temperatures appropriate to their metabolic processes (Tuttle and Stevenson 1977). An intermediate, unusable range of temperatures characterizes most caves, and bats use a very small number of caves with desirable conditions.

In the Southern Appalachians, most caves are found in carbonate valleys of the Ridge and Valley and the Cumberland Plateau (SAMAB 1996: 180). The Blue Ridge contains fissure caves and a smaller number of solution caves found in limestone or dolomite collapsed valleys and windows. Because of their rarity and vulnerability, their protection is a key conservation need within this region (SAMAB 1996: 37). Sinkholes and karstlands are scattered throughout the planning area, and large examples are rare. They are most common in the northern and central Ridge and Valley (Jefferson National Forest), as well as the Cumberland Plateau (Bankhead National Forest), with fewer occurrences known from the Blue Ridge (SAMAB, 1996: 189). Caves are absent from the piedmont and from the Sumter National Forest.

Abandoned mines have become key year-round resources for bats displaced from natural roosts, including caves and large hollow trees, by human disturbance (Tuttle and Taylor 1994). Abandoned mines may provide microclimates similar to those of caves. Mines are used for maternity sites, hibernation sites, migratory stopover sites, and temporary night roosts. Some bats rely heavily on use of mines range-wide, and many bat species are believed to hibernate exclusively in old mines or caves (Tuttle and Taylor 1994). One mine significant for Rafinesque's big-eared bat is known from the Andrew Pickens Ranger District, though others may be possible (Bunch et.al. 1998).

Direct and Indirect Effects

Possible threats to national forest caves and mines are: 1) direct disturbance from human visitation or improperly installed gates/closure devices, 2) management activities that indirectly result in alteration of temperature, humidity, surface water recharge or water quality, and 3) temporary decline in air quality due to prescribed burning (SAMAB 1996:90).

Provisions of the rare community prescription (9F) and forestwide direction apply to caves and mines that support cave-associated species and are the same across all alternatives. Direct disturbance from human visitation is regulated by a standard that requires use of proper closure devices for caves and mines supporting species at viability risk. Consistent inclusion of this standard under all alternatives is expected to reduce frequency and degree of human intrusion, providing beneficial effects to associated species.

Management actions that may result in indirect alteration of temperature, humidity, surface water recharge, or water quality within caves or mines include vegetation clearing and management, construction of roads, trails, and other recreation developments, and other use of heavy equipment. Standards under all alternatives provide for undisturbed buffers around significant caves and mines and associated features to maintain vegetative cover and moist microclimatic conditions. All mines are to be surveyed to determine use by bats and potential significance. For all mines suitable for supporting rare bat species, applicable standards will be followed including a buffer of 200 feet within which many activities are prohibited.

All caves and mines suitable for supporting characteristic fauna would be managed optimally for protection under all alternatives. Because of the priority put on protection of this community and associated species, effects of national forest management are expected to be positive under all alternatives.

Cumulative Effects

Caves and other karst features are naturally rare elements. In addition, a significant proportion of Southern Appalachian caves (95%) are located on private lands (SAMAB 1996: 37, 49) where protection may be poorly regulated. For these reasons, effects of protection of these habitats on national forest land is important to maintaining viability of associated species within the region.

Table Mountain Pine

Affected Environment

This community is characterized by a dominant or significant component of Table Mountain pine (*Pinus pungens*) in the overstory often in combination with pitch pine (*Pinus rigida*). It is found in the Appalachian region, commonly above 1,000 feet in elevation. Preliminary data by Frost (2002) suggests that pitch pine-Table Mountain pine /heath communities once occupied as much as 20% of the presettlement landscape. Primary management needs are maintenance and expansion of existing occurrences, using thinning and prescribed fire. This community corresponds to Table Mountain pine/pitch pine woodlands as defined in the Southern Appalachian Assessment (SAMAB 1996:185-186), and all associations within the following ecological group as defined by NatureServe (2001a):

401-80 Appalachian Highlands Pitch and Table Mountain Pine Woodlands.

In Table Mountain pine stands of the Great Smoky Mountains, associated tree species are red maple (*Acer rubrum*), blackgum (*Nyssa sylvatica*), sourwood (*Oxydendrum arboreum*), pitch pine, and chestnut oak (*Quercus prinus*). In Table Mountain pine-pitch pine stands, additional associated species include scarlet oak (*Quercuscoccinea*), American chestnut (*Castanea dentata*), and black locust (*Robinia pseudoacacia*). (Burns and Honkala 1990)

The lower canopy vegetation in Table Mountain pine stands includes rosebay rhododendron (*Rhododendron maximum*), Catawba rhododendron (*R. catawbiense*), Piedmont rhododendron (*R. minus*), mountain-laurel (*Kalmia latifolia*), mountain winterberry (*Ilex montana*), hobblebush (*Viburnum alnifolium*), blueberries (*Vaccinium* spp.), sawbrier (*Smilax glauca),* greenbrier (*S. rotundifolia*), fetterbush (*Pieris*

floribunda), white-alder (*Clethra acuminata*), black huckleberry (*Gaylussacia baccata*), bear huckleberry (*G. ursina*), wild grape (*Vitis* spp.), and male blueberry (*Lyonia ligustrina*). Mean shrub cover in the Great Smoky Mountains amounted to 65% in Table Mountain pine stands and 84% in Table Mountain pine-pitch pine stands. (Burns and Honkala 1990)

Bear oak (*Quercus ilicifolia*), mapleleaf viburnum (*Viburnum acerifolium*), and low sweet blueberry (*Vaccinium angustifolium*) are most important stand components only in the northern part of the range of Table Mountain pine.

Previous studies of Table Mountain pine regeneration following wildfires suggests that prescribed fires may need to be of high intensity to remove the forest canopy and expose mineral soil for successful regeneration (USDA 1965; Zobel 1969; Sanders 1992). Several recent studies suggest that although fire is needed for regeneration of Table Mountain pine stands, the intensity may vary depending on site conditions. Medium-high intensity burns may get desired results (Welch and Waldrop 2001).

Table Mountain pine has a very limited distribution in the Sumter National Forest. There are approximately 33 acres of Table Mountain pine stands in the timber stand inventory data (CISC), but the species occurs more commonly in mixed stands with pitch pine, shortleaf pine, and oaks. The known occurrences of Table Mountain pine communities on the Sumter National Forest include Poor Mountain, Toxaway Creek area, and along ridgelines higher than 1,000 feet in elevation.

Direct and Indirect Effects

Table Mountain pine forests are considered a rare community and are managed in all plan alternatives through the 9F (rare community) prescription. A forestwide objective included under the proposed forest plan is to restore from 500 to 2500 acres of Table Mountain pine forests. Table Mountain pine stands will be protected, maintained, or restored on appropriate sites and will not be cut or treated during vegetation management activities in order to maintain future restoration opportunities. Table 3-27 shows the expected activity levels related to the maintenance and restoration of Table Mountain pine forests.

Table 3-27. Expected Activity Levels related to the maintenance and restoration of Table Mountain pine forests for the Sumter National Forest by Alternative

Activity	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Average annual acres of Table Mountain pine forests to be restored	50-250	50-250	50-250	50-250	25	50-250	50-250
Average annual acres of Table Mountain pine forests to be burned	100-500	100-500	100-500	100-500	25	100-500	100-500

Table 3-27 indicates that all alternatives would increase the Table Mountain pine on the Sumter National Forest, compared to current management. Alternative G would have the most limited opportunities to manage for Table Mountain pine while Alternative B would provide the highest opportunities to manage for this community. Restoration and maintenance activities would benefit this community, however Table Mountain pine forests will remain rare and poorly distributed on National Forest System lands due to their naturally limited distribution.

Cumulative Effects

Table Mountain pine is limited in distribution on the Sumter National Forest and is concentrated in relatively small areas, typically with small acreages. Due to the dependence on prescribed fire, opportunities for expansion of this community on private lands are likely to be limited. Although limited in acreage, designation of Table Mountain pine as a rare community suggests that the maintenance and restoration on national forest lands will be a priority, and that the cumulative effects of implementing all alternatives above and beyond current management will be positive.

Rock Outcrops and Cliffs

Affected Environment

Rock outcrops and cliffs are defined here as rare communities and include the following types of communities as defined in the Southern Appalachian Assessment (SAMAB 1996:179-186) and by NatureServe (2001).

Talus Slopes

This community is characterized by nonvegetated or sparsely vegetated accumulations of rock at 2,500 to 4,600 feet elevation. It is found in the Appalachian region and is distinguished from forested boulderfields by the lack of trees, and from rocky summits by its occurrence on side-slopes as opposed to ridges and peaks. This community includes talus slopes as defined in the Southern Appalachian Assessment (SAMAB 1996:186), and all associations within the following ecological group as defined by NatureServe (2001):

430-10 Eastern Acid Talus

Forested Boulderfields

This community is characterized by rock fields, found at 3,500 to 5,300 feet elevation, that support a variable density of trees, typically dominated by yellow birch. It is distinguished from talus slopes by the presence of trees. It is found in the Appalachian region. This community includes boulderfields as defined in the Southern Appalachian

Assessment (SAMAB 1996:179), and the following associations as defined by NatureServe (2001a, 2001b):

CEGL004982	Southern Appalachian Hardwood Boulderfield Forest (Typic Type)
CEGL006124	Southern Applachian Boulderfield Forest (Currant and Rockcap Fern Type)

Cliffs and Bluffs

These communities are characterized by steep, rocky, sparsely-vegetated slopes, usually above streams or rivers. Cliff communities may be dry or wet and include communities associated with waterfalls, such as spray cliffs and rock houses. These communities are found in the Appalachian region. This community includes calcareous cliffs, mafic cliffs, sandstone cliffs, and spray cliffs as defined in the Southern Appalachian Assessment (SAMAB 1996:179,182,183,185), and all associations within the following ecological groups as defined by NatureServe (2001a):

430-40	Eastern Dry Acid Cliffs
430-45	Eastern Moist Acid Cliffs
430-50	Eastern Dry Alkaline Cliffs
430-55	Eastern Moist Alkaline Cliffs
430-60	Appalachain Highlands Northern White-Cedar Bluffs
430-65	Appalachian Highlands Rock Houses

Rock Outcrops

These communities are characterized by significant areas of exposed, usually smooth, exfoliating granite or related rocks, with scattered vegetation mats and abundant lichens. These communities are found in both the Appalachian and Piedmont regions. This community includes granitic dome and granitic flatrock as defined in the Southern Appalachian Assessment (SAMAB 1996:180-181), and all associations within the following ecological groups as defined by NatureServe (2001a):

435-10	Appalachian Highlands Granitic Domes
435-20	Appalachian Highlands Grantic Flatrock

Rocky Summits

This community is characterized by sparsely vegetated outcrops of fractured, irregular rock found above 4,000 feet elevation on peaks, ridges, and upper slopes. It is distiguished from rock outcrop communities by its fractured, irregular rock surface, and from talus slopes and cliff communities by its topographic position on or near summits. It differs from forested boulderfields in its general lack of forest cover. This community is found in the Appalachian region. This community includes high elevation rocky summits as defined in the Southern Appalachian Assessment (SAMAB 1996:182), and all associations within the following ecological group as defined by NatureServe (2001a):

436-30 Appalachian Highlands Rocky Summits

The known distribution of rare rock outcrop and cliff communities is described in the Southern Appalachian Assessment Terrestrial Technical Report (SAMAB 1996:188-190). According to this source approximately one-third of all occurrences of these communities in the southern Appalachian area are located on national forest lands.

Many species of viability concern are associated with rock outcrop and cliff communities (Appendix F). On the Sumter National Forest, talus slopes, forested boulderfields, moist alkaline cliffs, northern white-cedar bluffs, and rock houses are not likely to occur here, due to the lack of geological features which support their occurrence. On the Andrew Pickens, at least nine moist acid cliffs are known in association with waterfall spray zones or seepages (Zartman and Pittillo 1995), and dry alkaline cliff.

Potential is there for additional moist acid cliffs, and both dry alkaline and acid cliffs. On the piedmont districts, one low quality granitic flatrock community is known from the Enoree Ranger District, and there is the potential for additional flatrock or granitic dome communities on both Long Cane and Enoree Ranger Districts.

Direct and Indirect Effects

Rock outcrop and cliff communities are considered rare communities and will be managed optimally for protection, restoration, and/or maintenance through the 9F (rare community) prescription. This direction is the same under all plan alternatives, thus the effects of national forest management on these communities and associated species is expected to be positive. A subset of these communities is associated with riparian areas (spray cliffs, waterfalls, etc.), providing them with the additional protection afforded by the riparian prescription under all plan alternatives. Primary management strategies for these communities under all alternatives would be protection from disturbance by management activities and recreational uses; little to no vegetation management for maintenance or restoration is expected. These communities will remain rare and poorly distributed on national forest lands however, due to their naturally limited distribution.

Cumulative Effects

Cumulatively, these communities are vulnerable to negative impacts on private lands, making National Forest System sites critical to maintain.

Wetlands

Affected Environment

It is estimated that more than 50% of the Nation's wetlands have been destroyed in the past 200 years (Ernst and Brown 1988). They are vulnerable to destruction on private land and, therefore, it is critical to maintain these communities where they occur on national forest land. Wetlands have been ditched and drained for pastures, mined for peat (Ewel 1990), and filled for shopping centers. Loss of some wetlands can also be attributed to sedimentation, pollution, and plant succession due to fire suppression (USFWS 1991). Beaver activity has historically played an important role in creating open wetland habitats that are now rare on the landscape. Beaver wetlands are beneficial for many rare species such as monkey face orchid (Shea 1992), but may be detrimental to others such as bog turtle (Jensen, pers. commun.). Beaver impoundments also may cause unacceptable impacts to facilities and other resources.

Rare wetland communities in the Southern Appalachians and Piedmont include bogs, fens, seeps, ponds, river gravel-cobble bars, and river scour areas as defined in this section. Additional rare wetland communities may be found in association with small streams or floodplains in the piedmont of South Carolina.

Bogs, fens, seeps, and ponds may be found in both the Appalchian and Piedmont regions, and are characterized by 1) soils that are semi-permanently to permanently saturated as a result of groundwater seepage, perched water tables, rainfall, or beaver activity, but otherwise are generally nonalluvial, and 2) presence of wetland-associated species such as sphagnum, ferns, and sedges. Dominant vegetation may be herbs, shrubs, trees, or some complex of the three. Ponds in this group include limesink, karst, and depression ponds, which may hold areas of shallow open water for signficant portions of the year. Also included are all impoundments and associated wetlands resulting from beaver activity. Artificial impoundments are not included, unless they support significant populations or associations of species at risk. The primary management need is that of protection from activities that could disrupt wetland hydrology or other community structures and functions. Some sites may require periodic vegetation management to maintain desired herbaceous and/or shrubby composition. Rare wetland communities include mafic and calcareous fens, sphagnum and shrub bogs, swamp forest-bog complex, mountain ponds, seasonally dry sinkhole ponds, and beaver pond and wetland complex as defined in the Southern Appalachian Assessment (SAMAB 1996), and rare associations within the following ecological groups as defined by NatureServe (2001):

458-15	Appalachian Highlands Wooded Depression Ponds
458-20	Appalachian and Interior Highlands Limesink and Karst Wooded Ponds
470-10	Appalachian Highlands Forested Bogs
470-20	Appalachian Highlands Forested Acid Seeps
470-50	Appalachian Highlands Forested Fens and Calcareous Seeps
475-10	Appalachian Highlands Acid Herbaceous Seeps
475-20	Appalachian Highlands Alkaline Herbaceous Fens and Seeps

475-30 Appalachian and Interior Highlands Herbaceous Depression Ponds and Pondshores

Riverine and alluvial rare communities are characterized by: 1) sites adjacent to or within stream channels that are exposed to periodic flooding and scour, 2) presence of significant populations or associations of species at risk, and 3) groups of species locally uncommon in the piedmont, including bottomland oaks and bald cypress. Primary management needs are protection from disturbance during development of road crossings, and maintenance of desirable in-stream flows. Some restoration may be necessary. These communities include rare associations within the following ecological groups as defined by NatureServe (2001):

420-20 Appalachian Highlands Small Stream and Lower Slope Forest
420-xx Appalachian Highlands Large River Floodplain Forest
457-10 Appalachian Highlands Riverine Vegetation
457-30 Rocky Riverbeds
457-40 Appalachian Highlands Riverscour Vegetation

The SAA terrestrial report summarizes the approximate number of occurrences of some of these wetland communities on national forest lands in the Southern Appalachians (SAMAB 1996: 190). On the Sumter National Forest there are several known occurences of rare wetland communities, though limesink and karst wooded ponds, forested fens and calcareous seeps, alkaline herbaceous fens and seeps, and herbaceous depression ponds and pondshores are either not likely to occur here, due to lack of appropriate geology or elevation, or the associated rare communities are not currently considered rare by Natureserve. At least six rare wooded depression ponds are known from the Long Cane Ranger District on the Carolina slate belt, but more are likely to occur there. Rare wooded depression ponds are usually dominated by willow oak, and some examples are codominated by dwarf palmetto and oglethorpe oak (*Quercus oglethorpensis)*. At least three forested bogs are known from the Andrew Pickens Ranger District (sometimes containing *Juncus gymnocarpus)*, and three acid herbaceous seeps containing umbrella leaf (*Diphylleia cymosa)*, but more forested bogs and acid herbaceous seeps and bogs are possible. Forested acid seeps are possible on both Enoree and Long Cane Ranger Districts of the piedmont. Two good examples of rare rocky riverbed communities, dominated by shoal's spider lily (*Hymenocallis coronaria)* occur on the Long Cane Ranger District (Steven's Creek and the Savannah River). Examples of rare large river floodplain forests, dominated by bottomland oaks or American beech (on alluvial soils) are possible on both piedmont districts. Rare communities dominated by bald cypress are known from the Long Cane Ranger District, especially along Turkey and Stevens Creeks. Wetland rare communities support a large number of species of viability concern (Appendix F).

Direct and Indirect Effects

Wetland rare communities would be managed under all alternatives under the 9F rare community prescription for protection, maintenance, and where possible, restoration. These wetlands generally fall within riparian corridors, so provisions of the riparian prescription also would apply. Standards under all alternatives provide for protection of hydrologic function of wetland rare communities and prohibit fish stocking to maintain suitability for amphibian breeding. Beaver-created wetlands would normally be treated as rare communities, but beaver populations and impoundments could be managed to avoid adverse impacts to public safety, facilities, private land resources, at-risk species, and other rare communities.

Because wetland rare communities would be protected and maintained in all alternatives, no adverse direct or indirect effects to these communities are expected. Restoration efforts and creation of new wetlands through beaver activity may result in increased occurrence of these communities to the benefit of associated species. However, analysis indicates that, under all alternatives, wetland rare communities would remain uncommon on the forest because of their naturally limited distribution.

Cumulative Effects

Because all alternatives place priority on protection and maintenance of these communities, cumulative effects on national forest lands are expected to be positive. However, a significant proportion of Southern Appalachian wetland rare communities are located on private lands (SAMAB 1996: 190) where protection may be poorly regulated. For these reasons, protection of these habitats on national forest land is important to maintaining viability of associated species within the region.

Successional Habitats

Mix of Early and Late Successional Forests

Affected Environment

Successional stages of forests are the determining factor for presence, distribution, and abundance of a wide variety of wildlife. Some species depend on early-successional forests, some depend on late-successional forests, and others depend on a mix of both occurring within the landscape (Franklin 1988; Harris 1984; Hunter et.al. 2001; Hunter 1988; Litvaitis 2001). These habitat conditions are also important as wintering and stopover habitats for migrating species (Kilgo 1999; Suthers 2000; Hunter et.al. 2001). Therefore, it is important that varying amounts of both types of habitat be provided within national forest landscapes.

This section deals only with successional forest conditions. Permanent openings such as open woodlands, savannas, grasslands, barrens and glades, balds, wildlife openings, old fields, pastures, and rights-of-way are covered elsewhere in this document. Mid- and late-successional conditions are covered only generally in this section; more detailed treatment of desired conditions for these successional stages can be found under individual forest community sections.

For analysis purposes, forest succession is divided into four stages: early, sapling/pole, mid, and late (Table 3-28; after SAMAB 1996:11, 284). Early-successional forest is defined as regenerating forest of 0-to-10 years of age for all forest community types. It is characterized by dominance of woody growth of regenerating trees and shrubs, often with a significant grass/forb component, and relatively low density or absent overstory. This condition is distinguished from most permanent opening habitats by dominance of relatively dense woody vegetation, as opposed to dominance of grasses and forbs. Such conditions may be created by even-aged and two-aged regeneration cutting, and by natural disturbance events such as windstorms, catastrophic wildfire, and mortality caused by some insect or disease outbreaks. Ages defining the remaining successional stages vary slightly by forest community type. Sapling/pole forest is characterized by canopy closure of dense tree regeneration, with tree diameters typically smaller than 10 inches. Mid-successional forest begins to develop stratification of over-, mid-, and understory layers. Late-successional forests, usually greater than 80 years old, are characterized by trees with spreading crowns, a suppressed mid-story, an increase in mortality rates, emergence of super-canopy trees, and an understory dominated by shade tolerant species. Depending upon site conditions, this stage often contains the largest diameter trees and has well-developed canopy layers with an occasional random opening caused by tree mortality.

Table 3-28. Forest age (years) corresponding to successional stages for each forest community type.

Forest Community Type	Successional Stage: Early	Sapling/Pole	Mid	Late
Conifer-Northern Hardwood Forest, Mixed Mesophytic Forest	0-10	11-40	41-80	81+
River Floodplain Hardwood Forest, Eastern Riverfront Forest	0-10	11-20	21-60	61+
Dry-Mesic Oak Forest	0-10	11-40	41-80	81+
Pine and Pine-Oak Forest	0-10	11-40	41-80	81+
Dry and Xeric Oak Forest	0-10	11-40	41-80	81+
Dry and Dry Mesic Oak and Oak-Pine Forest	0-10	11-40	41-80	81+

Of particular importance as habitat are forest conditions that exist at both extremes of the forest successional continuum – early-successional and late-successional forests. Appendix F identifies species of viability concern associated with early-successional forests, mixed successional forest landscapes, and late-successional forests of a variety of forest community types.

Early-successional forests are important because they are highly productive in terms of forage, diversity of food sources, insect production, nesting and escape cover, and soft mast. Early-successional forests have the shortest lifespan (10 years) of any of the forest successional stages, are typically in short supply, and are declining on national forests in the Southern Appalachians (SAMAB 1996:28), and in the eastern United States (Thompson 2001). Early-successional forests are also not distributed regularly or randomly across the landscape (Lorimer 2001). These habitats are essential for some birds (ruffed grouse, chestnut-sided warbler, golden-winged warbler, prairie warbler, yellow-breasted chat, blue-winged warbler, Swainson’s warbler); key to deer, turkey, and bear in the South; and sought by hunters, berry pickers, crafters, and herb gatherers for the wealth of opportunities they provide (Gobster 2001). Many species commonly associated with late-successional forest conditions also use early-successional forests periodically or depend upon it during some portion of their life cycle (Hunter et.al. 2001).

Sapling/pole stages are generally of least value to wildlife because closed canopies limit understory development, and trees are not yet large and old enough to begin producing mast or other wildlife benefits. However, this successional stage does provide value as nesting, escape, resting, and winter foraging cover for some species. It is in this stage where most grape “slicks” and the largest amount of dead and decaying wood are found on the forest. Mid-successional forests begin to look and function like late-successional forests with multi-layered canopies and production of hard and soft mast. In most cases, this stage provides habitat for many species that use late-successional forests, except for those that require several large diameter trees to fulfill their life cycle needs.

Like early-successional forests, late-successional forests provide habitats and food supplies for a suite of habitat specialists as well as habitat generalists. These habitats are important providers of high canopy nesting, roosting, and foraging habitat; suitable tree diameters for cavity development and excavation; and relatively large volumes of seed and hard mast. Although it takes many decades for late-successional forest conditions to develop, these habitats are more common and contiguous across the Sumter National Forest and are dominant features in the SAA area (SAMAB 1996:28).

At the time of the SAA, national forest lands had only 3% of forest habitats in the early-successional stage, while 89% was in the mid- and late-successional classes; 45% of this was late-successional forest (SAMAB 1996:168). Other public lands were similar to the national forest. Conversely, private industrial lands had 22% in early-successional forest and only 4% in late-successional forest; private non-industrial had 8% in early-successional forest and 9% in late-successional forest (SAMAB 1996:168-169). The 20-year trends (SAMAB 1996:28) show early-successional forest on national forests decreasing by 4%, with late-successional forest increasing by 34%. Trends for private forests are mixed, with increases in both early- and late-successional forest percentages. These results likely reflect the mixed objectives of private landowners, with some focusing on commodity production and others on amenity values. In general, on national forest lands forest conditions are weighted heavily toward total acres of older forests, while private forests are providing a more balanced distribution of forest successional conditions from young to old (Trani-Griep 1999).

Quality of forest successional habitats may also vary between private and national forest lands. Objectives on national forests to provide for wildlife habitat needs, recreational activities, scenic integrity objectives, and water quality often result in greater vegetation structure retained in early-successional forests than in similar habitats on private lands. On private lands, more intensive management may simplify structure and composition, reducing habitat quality. Similarly, effort to restore and maintain desired ecological conditions and processes in mid- and late-successional forests also often enhances habitat quality over that found on private lands. For these reasons, conclusions regarding cumulative habitat availability from both private and national forest lands must be made with caution.

Hurricanes (Foster 1992), lightning frequency (Delcourt 1998), fire frequency (Whitney 1986), and pre-settlement cultural activities (Delcourt 1987) were probably the major sources of disturbance events that created early successional forests prior to European occupation. Less drastic perturbations such as mortality events from tornadoes, insect or disease outbreaks, or defoliation (passenger pigeon roosts) were typically less extensive and cyclic but nonetheless provided a source of early-successional forest conditions. Natural disturbances, however, are unpredictable, episodic, and heterogeneous (Lorimer 2001); influential at a landscape scale; and are neither uniform nor random in distribution. Anthropogenic disturbances occurred more frequently in floodplains along major rivers and in “hunting grounds.”

Overall, landscape patterns more consistently contain a component of early-successional forests in places more “likely” to be susceptible to disturbances, i.e., south and west facing slopes, sandy or well drained soils, or in fire adapted plant communities. Fire suppression, intensive agriculture resulting in massive soil losses, land use changes, and urban sprawl have drastically altered the variables that would perpetuate a landscape with a significant component of early- successional forests. With many species associated with early successional forests in the southeast in decline (Hunter et.al. 2001), it is imperative that management actions include some provision for perpetuating early-successional forest conditions. At the same time, many of these same factors, especially land use conversion, have reduced the distribution and abundance of quality late-successional forests across the larger landscape. Maintenance of these on public lands is equally important.

Abundance of early successional habitats is low throughout the Sumter National Forest and poorly distributed between communities (Table 3-29). Mid- and late-successional habitats appear to be well distributed and abundant among all forest communities.

Table 3-29. Current percentages of each community type on the Sumter National Forest by successional stage, 2002. (Old growth acres are included in "late.")

Forest Community Type	**Successional Stages in the Mountains** Early	Sapling/Pole	Mid	Late
Conifer-Northern Hardwood Forest, Mixed Mesophytic Forest,	0.6	27	16	56
River Floodplain Hardwood Forest, Eastern Riverfront Forest	0	0	0	0
Dry-Mesic Oak Forest	0.3	7.0	16	77
Pine and Pine-Oak Forest	4.2	15	28	53
Dry and Xeric Oak Forest	0	13	31	56
Dry and Dry-Mesic Oak-Pine Forest	1.2	1.2	29	69

Forest Community Type	**Successional Stages in the Piedmont** Early	Sapling/Pole	Mid	Late
Conifer-Northern Hardwood Forest, Mixed Mesophytic Forest	0	0.1	56	44
River Floodplain Hardwood Forest, Eastern Riverfront Forest	<0.1	2.3	8.3	89
Dry-Mesic Oak Forest	0.1	2.8	57	40
Pine and Pine-Oak Forest	6.9	19	34	40
Dry and Xeric Oak Forest	0	2.0	89	9.0
Dry and Dry-Mesic Oak-Pine Forest	1.0	10	60	29

Indicators of conditions related to successional forest habitats are acreage or percent of forested acres on the national forest within three categories of forest successional stages: 1) early successional forest, 2) mid- and late-successional forest combined, and 3) late-successional forest alone. These three indicators are selected because they are most relevant to describing important habitat conditions. Early-successional forests are a key condition required by many species, and their level indicates near-future presence of sapling/pole successional stages as well. Because most species associated with late-successional conditions will also be found to some extent in mid-successional forests, the combined level of these successional stages provides an indication of the total base of habitat available for these species. However, because late-successional forest conditions will often provide better quality habitat for these species, a focus on levels of this stage alone is also meaningful.

The prairie warbler (*Dendroica discolor*) is selected as management indicator species to represent early-successional forests. Because the mid- and late-successional forest habitats support more divergent communities depending on their composition,

management indicator species for these habitats are identified and analyzed under the individual major forest community sections of this document.

Prairie warblers are shrubland nesting birds found in suitable habitats throughout the Southern Appalachians and Piedmont (Hamel 1992). Prairie warblers require dense forest regeneration or open shrubby conditions in a forested setting. Near optimal habitat conditions are characterized by regeneration, thinned area or patchy openings 10 acres or more in size where woody plants average 2 to 3 meters in height, 3 to 4 cm dbh, and occur in stem densities around 3,000 stems/acre (Natureserve 2001). Populations respond favorably to conditions created 3 to 10 years following forest regeneration in larger forest patches (Lancia 2000). Providing a sustained flow of regenerating forests is necessary to support populations of prairie warbler. Populations of prairie warbler have been steadily declining in the eastern United States (Trend -2.08, P value 0.0000; Sauer 2000). Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

The American Black Bear *(Ursus Americanus)* is selected as a management indicator species to represent a mix of successional forests. Combinations of forests old enough to produce hard mast, forests with den trees, forests with a proliferation of soft mast, with high stem densities are important to fullfull life requirements of the black bear year round. Populations of this species are tracked by monitoring indicies that suggest trends, i.e. scent station surveys, harvest totals. Black Bear is known only to occur on the Andrew Pickens Ranger District.

Direct and Indirect Effects

To guide provision of forest successional habitats in the draft plan and to facilitate effects analysis, four different mixes of successional forest conditions were defined and assigned to prescriptions, which were then allocated to national forest lands. These four options describe objectives for percentages of early-successional forest to be provided by natural causes or management actions, percentages of mid- and late-successional forests combined (including old growth), and percentages of late-successional forest (including old growth). Objectives were set for these measures because these were deemed the most meaningful measures of habitat availability for dependent species. The options were designed to cover the full spectrum of successional mixes needed to cover the range of preferences documented for forest-associated species. In other words, if each of these options is allocated to some portion of the landscape, all forest-associated species should find some portion of the landscape with optimal successional forest mixes.

Option 1 is assigned to those areas for which there are no specific objectives for creating early-successional forests through management actions. These areas would be expected to provide primarily mid-and late-successional forest habitats in the short-term, with late-successional forest conditions eventually predominating.

Option 2 areas are also areas with no specific objectives for early-successional forests, but creation of such habitat through management action may provide up to 4% of forested acres in early-successional forest conditions, where compatible with the emphasis of the prescription. These areas have an objective of a minimum of 75 % of forested acres in mid- and late-successional forest and a minimum of 50% in late-successional forest. Therefore, these areas also are expected to become dominated by late-successional forests over time.

Option 3 areas are characterized by objectives to create an intermediate mix of forest successional stages, with 4 to10% of forested land in early-successional forest condition. Objectives for older forests in these areas are to maintain a minimum of 50% of forested acres in mid- to late-successional forest and a minimum of 20% in late-successional forest.

Option 4 areas are characterized by a mix of forest successional stages, with an emphasis on early-successional forests. Objectives are to maintain 10 to 17% of forested acreage in early-successional, 20% in mid-and late-successional forests, and 10% in late-successional forest. Expected percentages of successional forest conditions by option are summarized in Table 3-30.

Table 3-30. Desired percentage of forested acreage in early-successional, mid- and late-successional, and late-successional forest by successoinal mix options allocated to national forest lands.

Successional Mix Option	Early Successional	Mid- and Late-Successional	Late-succesional
1	0	100	100
2	0-4	>75	>50
3	4-10	>50	>20
4	10-17	>20	>10

Allocation of these prescription options to national forest lands varies across alternatives. Forestwide mixes of successional habitats by alternative may be compared by comparing the acreage allocated to each of these four successional stage options (Table 3-31). These allocation percentages may be combined with desired successional mix percentages (Table 3-30) to estimate total forestwide successional forest mixes (Table 3-31). These estimates represent unconstrained attainment of forest successional stage objectives, and provide an additional means of comparing alternatives.

Table 3-31. Percent of total forest acres allocated to successional stage options 1, 2, 3, and 4, by forest plan revision alternative, and projected percentages of total forested acreage to be maintained in early successional forest, mid-and late-successional forest, and late-successional forest, if option objectives are met, Sumter National Forest.

Alternative	% of Forested Acreage Allocated to Forest Successional Mix Option				Estimated % of Forested Acreage by Successional Stage		
	1	2	3	4	Early	Mid and Late	Late
A	13	0	22	65	7.4- 13.3	> 52	> 39
B	20	3.6	64	12	3.8 - 8.6	>72	>50
D	9.3	0	1.4	89	8.9 - 15	>42	>33
E	26	4.0	31	39	5.2 – 9.9	>67	>53
F	6.9	0	8.7	84	8.7 - 15	>28	>17
G	37	21	28	14	2.5 – 6.0	>84	>69
I	15	0	45	40	5.8 - 11	>60	>42

SPECTRUM modeling provides a means for examining attainment of desired successional mixes at particular points in time within the constraints of other factors such as existing age-class distribution. Modeled mixes of successional stages at 10 and 50 years of plan implementation vary by alternative due to the differences in management intensity and emphasis (Tables 3-32, 3-33, and 3-34).

Table 3-32. Expected percent of forested acreage in early-successional forest conditions on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	3.8	4.9	13.0	9.5
Alternative B	2.3	6.9	5.1	6.3
Alternative D	7.5	7.5	10.0	9.2
Alternative E	2.1	5.1	7.8	7.8
Alternative F	7.7	8.3	14.0	13.0
Alternative G	0	0.4	5.9	5.8
Alternative I	2.8	3.4	11.0	9.1

Table 3-33. Expected percent of forested acreage in mid- and late--successional forest conditions on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (Derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	79	74	66	61
Alternative B	90	50	74	76
Alternative D	76	58	69	64
Alternative E	80	78	71	76
Alternative F	74	48	65	55
Alternative G	81	94	73	80
Alternative I	69	63	68	65

Table 3-34. Expected percent of forested acreage in late-successional forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	57	54	32	18
Alternative B	68	28	40	45
Alternative D	53	41	35	19
Alternative E	57	59	37	39
Alternative F	51	31	31	6.8
Alternative G	58	76	39	50
Alternative I	47	42	34	29

Range-wide densities for prairie warbler average less than one breeding pair/ha with a range of 0.7 pairs/ha in western Massachusetts and up to 2.5/ha in southeastern Massachusetts (NatureServe 2001). Mean breeding densities calculated from several studies and reported by Hamel (1992) is 0.4 breeding pairs/ha. Mean territory size was 1.6 ha in Indiana and 0.5 ha in Maryland (Natureserve 2001). In a multi-year study in South Carolina, breeding densities were recorded from 0.3 to 0.6 pairs/ha in a longleaf pine plantation (Droge 1993; Wagner 1994; Irby 1995; Irby 1996) with peak densities occurring in years six and seven.

Because of the tight association of breeding prairie warblers with early-successional forests, prairie warbler populations are expected to vary by alternative in direct relation to the abundance of this successional stage.

Cumulative Effects

Across the landscape which contain the Sumter National Forest, the mix of successional forest stages will be affected by actions on private lands, insect and disease outbreaks, catastrophic wildfire, and storms that serve to create relatively large patches of canopy tree mortality. Although activities on private lands, outbreaks, and storms are difficult to predict, levels of these influences are not expected to vary across alternatives. These

external factors would be considered in site-specific planning under all alternatives to moderate cumulative effects. Early-successional forests created by outbreaks or storms would be included in calculations of existing conditions, which would be used to determine whether management actions are needed to meet early-successional forest objectives. Presence of quality successional forest habitats on surrounding private lands, to the extent they can be known, would be considered during site-specific planning to determine where within the range of successional forest objectives is most desirable for national forest lands. However, in order to provide for the diversity of plant and animal communities on national forest land as required by the National Forest Management Act, effort would be made under all alternatives to achieve successional mixes on national forest lands that are within the objectives or desired conditions of each allocated prescription and its associated successional mix option. Although exact mixes would vary somewhat across alternative as described in the preceding section, when viewed cumulatively across the landscape, it is expected that the national forest lands would provide a higher proportion of late-successional forests compared to early-successional forests under all alternatives.

Permanent Openings and Old Fields, Rights-of Way, Fire Breaks, and Closed Roads as Linear Strips

Affected Environment

Habitats considered here include permanent openings and old fields, utility rights-of way, and linear strips. Other early successional habitats such as woodlands, grasslands, savannas, and early successional forests are discussed elsewhere in this document.

The Eastern wild turkey (*Meleagris gallopavo)* is selected as a management indicator species for this collection of early successional habitats. Turkey utilize these unique habitats in forested areas for nesting, brood rearing, and periodically though out the year for food. Turkey populations respond to a variety and distribution of these habitat conditions. Turkey can be found throughout the Sumter National Forest. However, populations are declining on the Andrew Pickens District and are somewhat stable in the Piedmont.

Permanent Openings and Old Fields

Permanent grass/forb and seedling/sapling/shrub habitats are important elements of early successional habitat. Permanent openings typically are one of two types: 1) maintained for wildlife habitat on an annual or semi-annual basis with the use of cultivation, mowing, burning, or other vegetation management treatments, or 2) shrub dominated patchy thickets with a high component of fleshy fruit producers (plum, persimmon, crabapple, dogwood, etc.) interspersed with native grass and forb species. The first type may also be planted to native grasses and forbs (partridge pea, switch grass, bluestem, etc.) or may be planted to non-invasive agricultural species such as clover, annual rye,

chufa, wheat, millet, or other small grains. The second type of opening is commonly referred to as old fields that are kept in a shrubland openland condition. These are maintained on a less frequent basis (5-10 year intervals, usually with burning and mowing or selective cutting). They are largely influenced by past cultural activities and often contain fruit trees (pear, apple), sumac, grape tangles, briar patches, and a preponderance of annual and perennial herbs, grasses, woody shrubs, and tree seedlings. Many of the existing openings on the Sumter National Forest are a combination of these two types.

Permanent openings are used by a variety of wildlife, both game and non-game species. Parker et. al. (1992) reported use of agricultural openings by 54 species of birds and 14 species of mammals in a study on the Chattahoochee National Forest. Bird species observed included wild turkey, several species of raptors and woodpeckers, and numerous songbirds including a number of neotropical migrants such as pine warbler, ovenbird, and black-throated green warbler. The greatest number of avian species and highest bird species diversity was found within the edge zone of the openings. Mammals observed included species such as white-tailed deer, striped skunk, woodchuck, bobcat, black bear, red bat, eastern cottontail, opossum, and several small mammals.

The benefits of permanent openings to white-tailed deer are well documented. Permanent openings, especially those containing grass-clover mixtures, are used most intensively in early spring, but also are an important source of nutritious forage in winter, especially when acorns are in short supply (Wentworth et.al. 1990; Kammermeyer et.al. 1993). Kammermeyer and Moser (1990) found a significant relationship between openings and deer harvest with only 0.13% of the land area in high quality openings. Forest openings also are a key habitat component for wild turkeys throughout the year (Thackston et.al. 1991; Brenneman et.al. 1991). Maintained openings provide nutritious green forage in the winter and early spring and seeds during late summer and fall. Because of the abundance of insects and herbaceous plants produced in these openings, they are especially important as brood-rearing habitat for young turkeys (Nenno and Lindzey 1979; Healy and Nenno 1983). Linear openings, especially those associated with young regenerating forests, provide optimal brood habitat conditions for ruffed grouse (Dimmick et.al. 1996).

There also are numerous wildlife benefits from openings maintained in native species. Native warm season grasses provide nesting, brood-rearing, and roosting habitat for northern bobwhite and other grassland species of wildlife (Dimmick et.al. 2001). Native species are well adapted to local environments and generally require less intensive maintenance following establishment.

Old fields provide food and cover for a variety of wildlife species. A number of disturbance-dependent birds, such as northern bobwhite, grasshopper sparrow, golden-winged warbler, and blue winged warbler are associated with old field habitat (Hunter et.al. 2001). Recently abandoned fields are important for rabbits and many small mammals (Livaitis 2001). Woodcock use old fields as courtship, feeding, and roosting sites (Straw et.al. 1994; Krementz and Jackson 1999). Although managed less

intensively than other types of permanent openings, some degree of periodic management is necessary to maintain these habitats.

There currently are approximately 1,225 acres of permanent openings (including old fields) on the Sumter National Forest (Table 3-35). This represents 0.3 % of the total national forest acres on the Sumter. A number of the openings are old farm sites that were in cultivation when the lands were acquired by the Forest Service. Others were created by the expansion of log landings following timber harvest or by closing and seeding old roads to create linear openings. All 1,225 acres are on State Wildlife Management Areas (WMAs) and are cooperatively maintained by South Carolina DNR and the Sumter National Forest.

Table 3-35. Current acreage and percent of total forest acres of permanent openings, rights-of-way, and improved pastures on the Sumter National Forest 2002.

	Mountains	Piedmont
Total acres permanent openings [1]	245acres	980 acres
% of total Forest acres	0.3	0.4
Total Acres of ROW	92	3320
% of total Forest acres	0.1	1.2
Acres of closed roads maintained as linear strips	80	500
% of total Forest acres	0.1	0.2

1 Includes old fields that are managed for wildlife

Rights-of-Way, Fire Breaks and Closed Roads

Utility rights-of-way (ROW), firebreaks, and closed roads typically are managed for purposes other than to provide wildlife habitat. However, they can provide wildlife benefits if managed appropriately. Rights-of-way can be established and maintained in plantings that enhance food and seasonal cover to many species of wildlife. Once established, ROW maintenance costs generally are reduced. The conversion of fescue or other non-native sod to native forbs and grasses improves habitat conditions for northern bobwhite and numerous grassland species (Dimmick et.al. 2001). Maintaining roadways by periodically (every 2 to 3 years) establishing ground cover consisting of a combination of legumes, grasses, and cereal grains controls woody plant invasion, keeps roads in good condition, and makes high value food sources available to wildlife over a large area with minimal disturbance. Fuel breaks are located and maintained to provide a position to control prescribed burns or combat wildfire. Establishment of ground cover that is either green when fire dangers are elevated in early spring and late fall or does not form dense sod or produce volatile fuels can serve wildlife needs as well as aid in maintaining firebreaks. Roadways and firebreaks maintained in this manner are often referred to as linear strips.

The current acreage in utility rights-of-way and closed roads is shown in Table 3-35. Rights-of-way were estimated to average 100 feet in width, and closed roads an average of twelve feet in width. The acreages in rights-of-way and closed roads are relatively stable on the forest from year-to-year. Firebreaks are established on an as-needed basis, are largely ephemeral in nature, and acreage in this condition is highly variable in any given year.

Direct and Indirect Effects

Permanent Openings and Old Fields

The management prescriptions vary in how they treat the creation and maintenance of permanent openings. Each prescription has been assigned to one of three options.

Option 1 - Existing old fields and wildlife openings are not maintained, but are allowed to succeed to forest. In some cases, existing openings may be obliterated through tree planting and elimination of non-native species. New permanent wildlife openings are not created.

Option 2 - Existing old fields and openings for wildlife may be present and maintained, but no creation of new permanent openings of this type occurs. Native species are emphasized when establishing food plants for wildlife. Some openings provide permanent shrub/sapling habitats as a result of longer maintenance cycles.

Option 3 - Existing old fields and openings for wildlife may be present and maintained. Expansion of existing openings and/or creation of new openings may occur. Non-invasive non-natives are sometimes used when establishing food plants for wildlife, but native species are used where feasible and cost effective. Some openings provide permanent shrub/sapling habitats as a result of longer maintenance cycles.

No specific objectives for the quantity of permanent openings are established in the revised forest plan. Through the prescription allocation process however, the forest is zoned into areas of varying intensity of opening maintenance and development. Alternatives vary widely in amounts, but all add some acreage dedicated to permanent wildlife openings. For analysis, a forestwide goal for permanent wildlife openings was calculated for each alternative that reflects the desired future conditions of the mix of prescriptions within each alternative (Table 3-38). The actual amount of area dedicated to openings for a specific portion of the forest will be determined through site-specific analysis.

In order to protect established vegetation, a forestwide standard has been included that prohibits recreational (e.g., horseback riding, mountain biking, OHV use, and camping) on all permanent wildlife openings, including linear strips.

Table 3-36 displays the acres of existing permanent openings in each management prescription by alternative for the Sumter National Forest. Table 3-37 displays existing

permanent openings by wildlife opening option by alternative. All acres in permanent wildlife openings in the column under Option 1 would be retired. Tables 3-39 and 3-40 display the expected amount and distribution of permanent openings across the Sumter National Forest for each alternative.

Table 3-36. Acres of Existing Permanent Openings in each Management Prescription by Alternative on the Sumter NF.

Mgt. Rx	Alternative A	Alternative B	Alternative C	Alternative D	Alternative F	Alternative G	Alternative I
1A							
1B	12	2		2		2	
2A1	0	0	0	0	0	0	0
2A2							
2A3	35	35	35	35	35	35	35
2B1	3	3	3	3			
2B2	28	91	72	46			41
2B3		2	2				2
4D	24	9	25	32	4	50	4
4F	41	46	49	46	75	73	78
4G1	4	4	4	4	4	4	4
5A							
5C							60
6A						177	
6B		19		73		76	
6C	0	71	0	51			0
6D		60		36		193	
6E						66	
7A							3
7C	2			2			
7D	8	8	8	8	8	8	8
7E1					0		35
7E2	181			235			277
8A1				59	612		138
8A2							
8B2		51		391			36
8C		4					
8D							
9A3		141				93	60
9A4						231	
9E		165					
9F	1	1	1	1		1	1
9G2		440				145	46
9H		74					
10B	831		1027		482	72	398
11					6		
12A	56			202			
12B							

Table 3-37. Acres of Existing Permanent Openings in each Permanent Opening Option by Alternative on the Sumter NF.

Alternative	Piedmont		
	Option 1 No Maintenance of Existing Openings	Option 2 Existing Openings Maintained/ No new openings	Option 3 Existing Openings Maintained/ New openings allowed
Alternative A	36	175	1014
Alternative B	102	903	220
Alternative D	26	172	1027
Alternative E	158	380	687
Alternative F	4	128	1094
Alternative G	305	848	72
Alternative I	5	311	849

Table 3-38. Anticipated percent forest in permanent wildlife openings and linear strips on the Sumter National Forest by Alternative

	Alt A	Alt B	Alt D	Alt E	Alt F	Alt G	Alt I
Percent in openings	3%	0.7%	3%	4.1%	5%	0.6%	2.5%

Table 3-39. Anticipated acreage and percent forest in permanent openings and linear strips on the Andrew Pickens District of the Sumter National Forest

Activity	**Alt A**	**Alt B**	**Alt D**	**Alt E**	**Alt F**	**Alt G**	**Alt I**
Total acres 10 years	460 (0.6%)	300 (0.4%)	660 (0.8%)	820 (1.0%)	1,020 (1.2%)	280 (0.3%)	1,040 (1.3%)
Total acres in 50 years	2,140 (2.6%)	520 (0.6%)	2,200 (2.6%)	2,960 (3.6%)	3,600 (4.3%)	400 (0.5%)	1,760 (2.1%)

Table 3-40. Anticipated acreage and percent forest in permanent openings and linear strips on the Piedmont Districts of the Sumter National Forest

Activity	**Alt A**	**Alt B**	**Alt D**	**Alt E**	**Alt F**	**Alt G**	**Alt I**
Total acres in 10 years	1,840 (0.7%)	1,200 (0.4%)	2,640 (1.0%)	3,280 (1.2%)	4,080 (1.5%)	1,120 (0.4%)	1,760 (0.6%)
Total acres in 50 years	8,560 (3.1%)	2,080 (0.8%)	8,800 (3.2%)	11,840 (4.3%)	14,400 (5.2%)	1,600 (0.6%)	7,040 (2.6%)

Alternatives A, D, F, and I would retain existing distribution and abundance of wildlife openings on the forest. Alternative E would slightly alter the existing distribution, and all alternatives except B and G would add substantial acreage dedicated to permanent wildlife openings and linear strips. Recreational opportunities for viewing wildlife and hunting would benefit accordingly.

Rights-of-Way, Firebreaks, and Closed Roads

In general, existing utility rights-of-way will be treated similarly under all alternatives. Rights-of-way typically are managed by third parties who should be encouraged to manage these to the extent possible to enhance their value to early-successional species. In addition, forestwide standards have been established that prohibit broadcast herbicide application for maintenance and require site-specific environmental analysis prior to maintenance operations.

Cumulative Effects

Permanent openings are an important habitat element for a variety of birds (resident and migratory), mammals, reptiles, and insects in a forested landscape. However, they are poorly distributed and currently comprise a small percent (0.3%) of the landscape of the Sumter National Forest.

Habitat conditions provided in permanent openings are very different from what is provided by pastures, orchards, other agricultural fields, and golf courses that are much more common on adjacent private land. Generally, the openland conditions on private land are not maintained to benefit nesting, brood-rearing, food, and cover for wildlife and are not comparable to permanent wildlife openings on a national forest. In addition, the Forest Service does not have control of management of openings on private land. Land uses in areas that currently provide some habitat on adjacent private lands may be developed in the future and therefore cannot be relied on to provide long-term wildlife benefits.

Maintenance of existing openings and development of a meaningful level and distribution of a network of openings and linear strips (Alternatives A, D, E, F, I) on a national forest will predictably provide long-term wildlife benefits. It therefore is important to maximize the benefits from this limited acreage dedicated to permanent wildlife openings on the forest by maintaining them in high quality habitat conditions. It is not expected that private landowners will restore or manage to maintain significant amounts of high quality wildlife openings, and they would remain limited in abundance on the landscape without national forest maintenance and establishment efforts. Other open-land habitats such as rights-of way may provide wildlife benefits similar to openings if managed with wildlife considerations in mind.

Old Growth

Affected Environment

Very little "true" old growth is thought to remain in the eastern United States (Smith and Hamel 1991) but inventories are lacking. Site-specific inventories conducted for old growth on the Sumter National Forest include those by Paul Carlson in the Chattooga Watershed (1995), by Chick Gaddy in the Lower Chauga Watershed (1998), and by Clemson University on FS acquired land in the Jocassee Gorges Area (2001). Other inventories for old growth have been conducted periodically by Forest Service personnel.

Issues related to the amount of future old growth which should be provided on the Forest, as identified during initial scoping conducted in 1996-1997, include old growth needed to provide for wildife habitat (specifically for black bear) and for botanical values, old growth for recreational values and to research old growth processes, to provide woody debris for streams and terrestrial ecosystems, old growth for aesthetic and spiritual values, for developing plants which may harbor medicinal values, and for natural heritage or public heirlooms to be passed on, from one generation to the next. Some commented that maintaining acreage in old growth will increase costs, reduce volumes and timber values, reduce biodiversity, and pose forest health risks. Others commented that the amount of old growth should increase, and that there should be an ample and well-distributed network of old growth restoration areas.

In June of 1997 the Southern Region of the Forest Service completed a report entitled Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region, hereafter called the "old growth report" (Forest Service 1997). The old growth report contains direction for providing conditions for old growth to develop, in conjunction with Forest plan revision (old growth report, p.8-22), including direction for conducting a preliminary inventory for old growth, to be used as a tool in Forest planning, definitions for several old growth community types, and direction for providing for a network of small, medium, and large-sized patches of old growth on the National Forests based on social, biological, ecological, and spiritual issues and concerns.. The Southern Appalachian forests undergoing forest plan revision are committed to implementing the old growth report across all alternatives.

The Southern Appalachian Assessment (SAA) pre-dates the development of the regional old growth report. The SAA combined the late-successional and potential old growth vegetation stages and found that they represented slightly more than 18% of the assessment area considering all ownerships (SAMAB 1996, Report 5:24). Within this 18%, rounded percents were; national forest 42%, private non-industrial forest 36%, other public 20%, and private industrial 1% (SAMAB 1996, Report 5:26). Across the assessment area, the three most commonly represented forest cover type groups were, in order: oak-hickory, oak-pine, and southern yellow pine. The late-successional and old growth combined group was 45% of national forest and an estimated 54% of other public (SAMAB 1996, Report 5:168). On national forest there had been a trend of increase in the late-successional and old growth stage acreage during the period from the mid-1970s

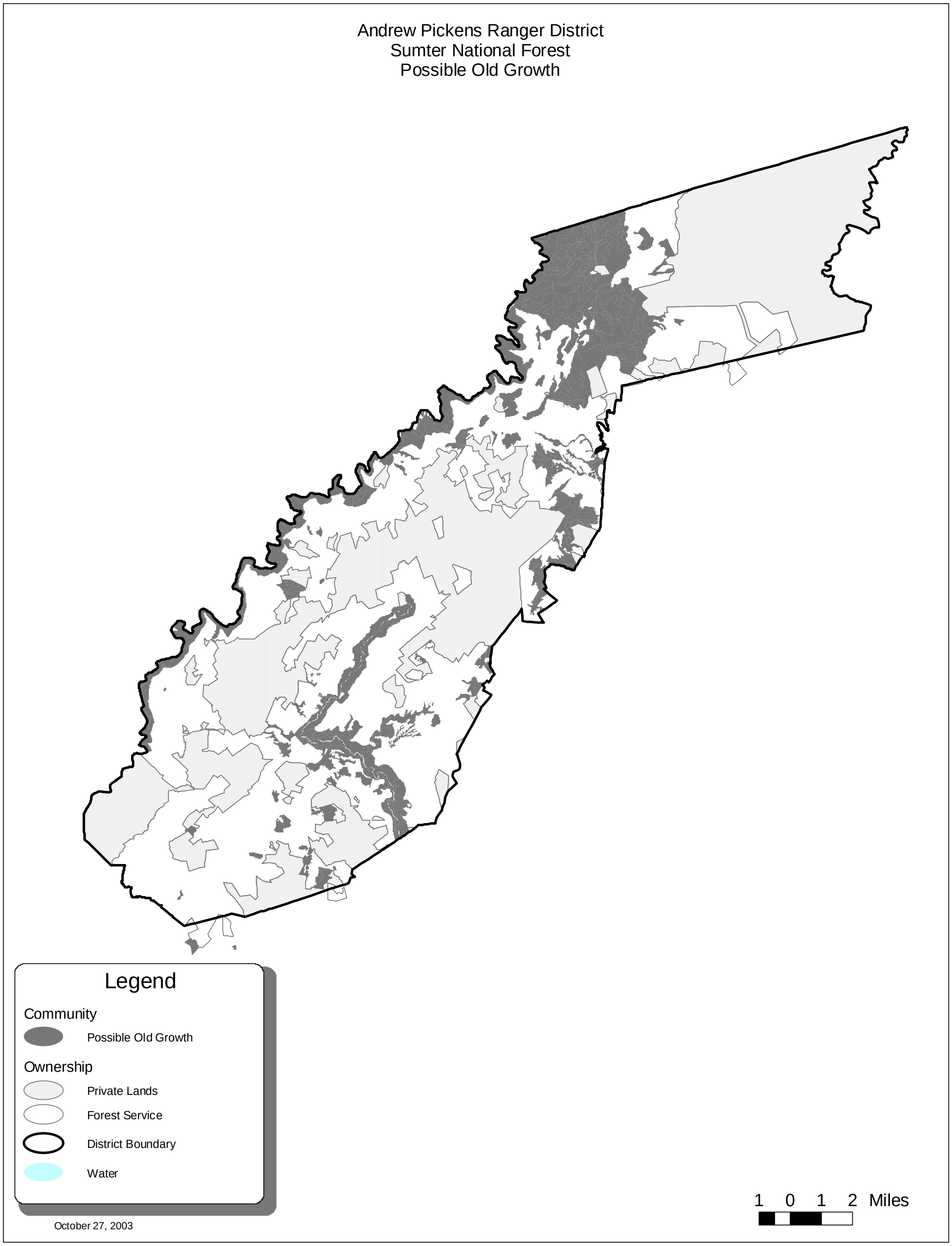
to 1995 in each forest type group (SAMAB 1996, Report 5:173). In addition, within the assessment area, unsuitable acreage (not planned for timber harvest) exceeded suitable (planned for timber harvest) acreage on national forest for each old growth type group except: (a) river floodplain hardwood forest and (b) eastern riverfront forest. Total national forest acreage was 1,098,491 with 61% of that being unsuitable (SAMAB 1996, Report 5:178).

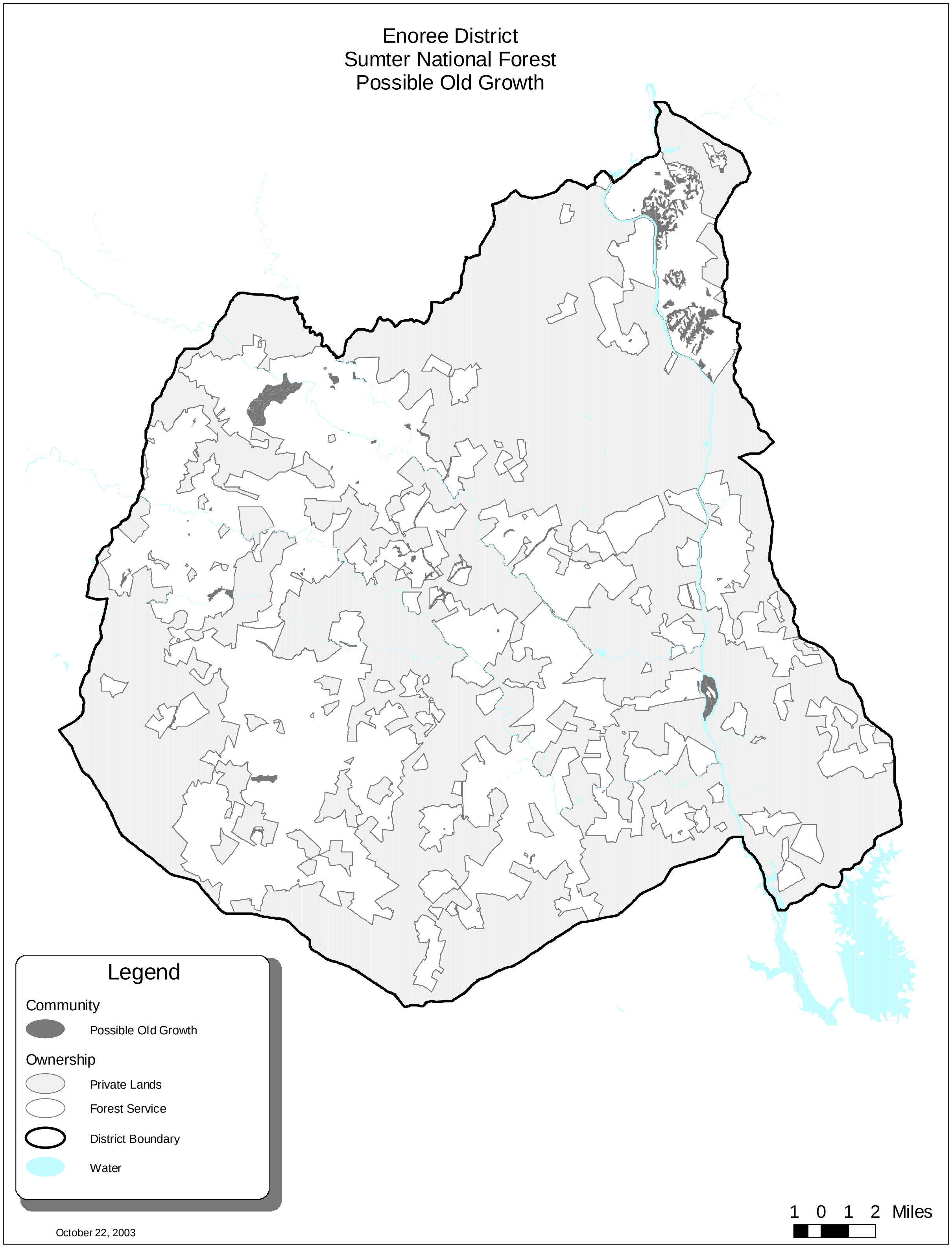
Consistent with direction in the old growth report, the Sumter National Forest developed a "Preliminary Inventory of Possible Old Growth Forests," hereafter called "possible old growth inventory." The possible old growth inventory was developed initially in 1997, and the same old growth attributes were reran using GIS in 2002. The possible old growth inventory was based on existing data as described in the old growth report (pp.8-11). Sources of data on the Sumter National Forest included Jones (1988); Carlson (1995); selected stands from Gaddy (1998); timber stand inventory data (2002); and unsuitable land as identified in the 1985 Sumter forest plan. Changes in possible old growth acres, occurring between 1997 and 2002, were a result of changes in interpretation of unsuitable lands as defined in the 1985 Forest Plan. Select unsuitable acreages found in the Calhoun Experimental Forest, and select areas included from proposed botanical areas, were eliminated from the 2002 coverage based on site-specific inventories. In 2003, a query of the 2002 updated possible old growth inventory resulted in acreages in five possible old growth community types as follows (Table 3-41):

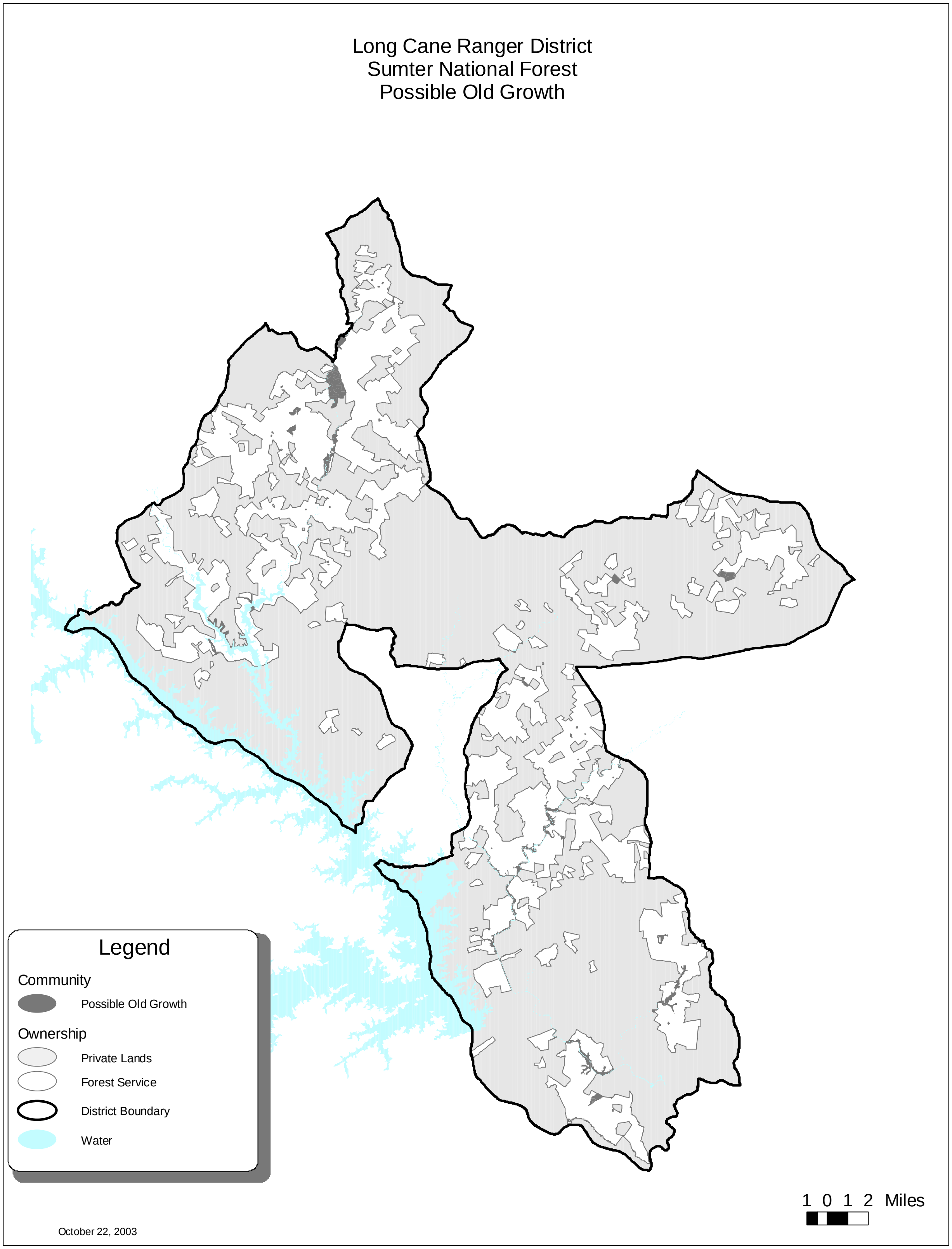
Table 3-41. Acres on the Possible Old Growth Inventory by Community Type and Ecological Section for the Sumter National Forest, 2002

Community #	**Community**	**Blue Ridge** (acres)	**Piedmont** (acres)
2/5	Conifer/Northern Hardwood & Mixed Mesophytic Forests	7702	85
13/28	River Floodplain & Eastern Riverfront Forests	156	2103
21	Dry-mesic oak forests	5706	3298
22/24	Dry-xeric oak forest, woodland, savanna	2583	7
25	Dry-mesic oak-pine & pine-oak	7563	864
TOTAL		**23,710**	**6,357**

Source: *Plan revision CISC data, base year 2003 * loblolly pine was eliminated from this analysis*


Andrew Pickens Ranger District
Sumter National Forest
Possible Old Growth
Legend
Community
Possible Old Growth
Ownership
Private Lands
Forest Service
District Boundary
Water
October 27, 2003
1 0 1 2 Miles


Enoree District
Sumter National Forest
Possible Old Growth
Legend
Community
Possible Old Growth
Ownership
Private Lands
Forest Service
District Boundary
Water
1 0 1 2 Miles
October 22, 2003

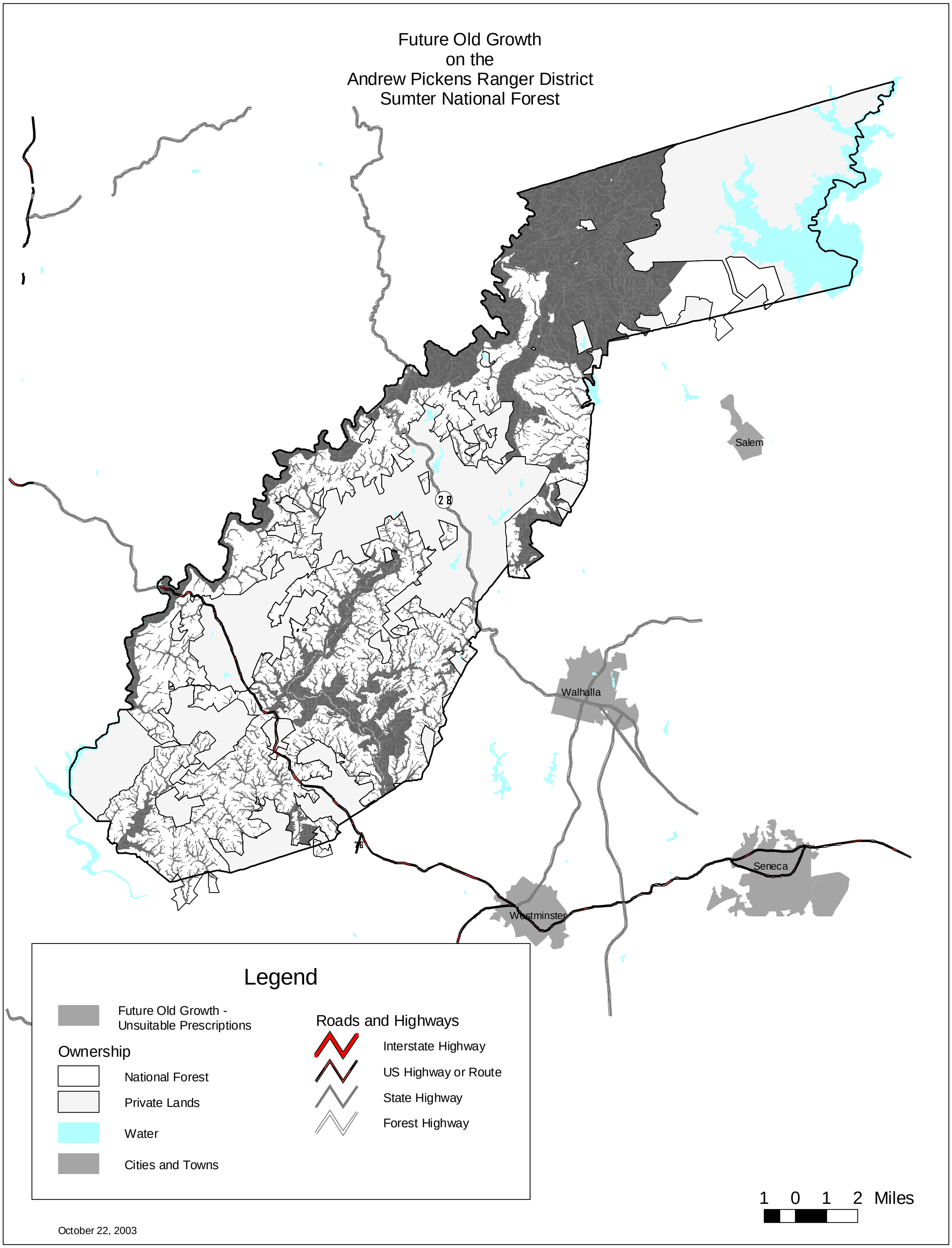

Long Cane Ranger District
Sumter National Forest
Possible Old Growth
Legend
Community
Possible Old Growth
Ownership
Private Lands
Forest Service
District Boundary
Water
1 0 1 2 Miles
October 22, 2003

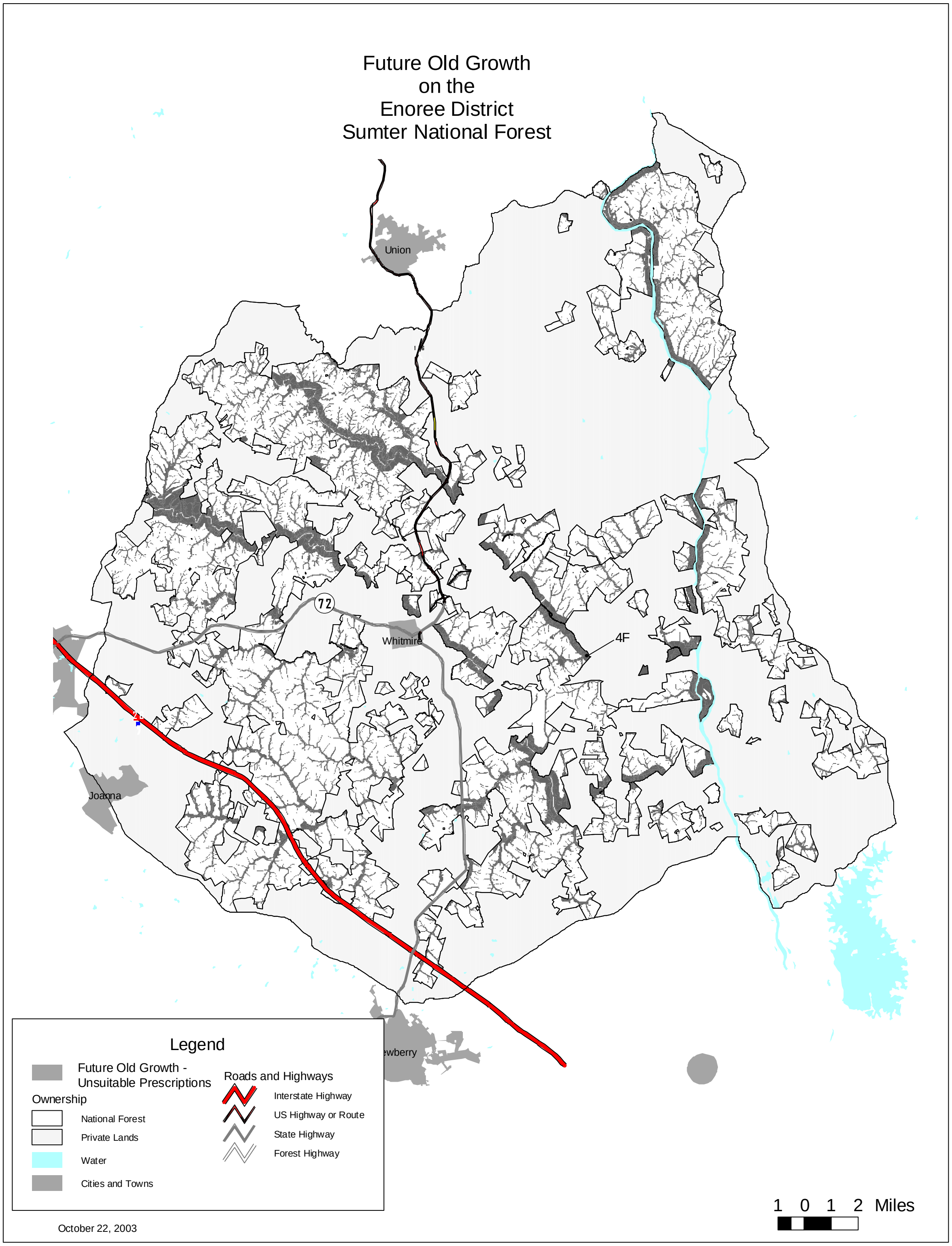
The forests will provide for an adequate representation of old growth community types (old growth report, p.18). To address the ecological capabilities on the Sumter National Forest in providing for a variety of old growth community types, the following displays the acreage in communities (crosswalked to a forest type, site index combination), independent of age (Table 3-42). Loblolly pine stands, which are anthropogenic in origin, are listed separately. The crosswalk for determining dry-xeric communities (type 22/24), differed from that used for the possible old growth inventory (above).

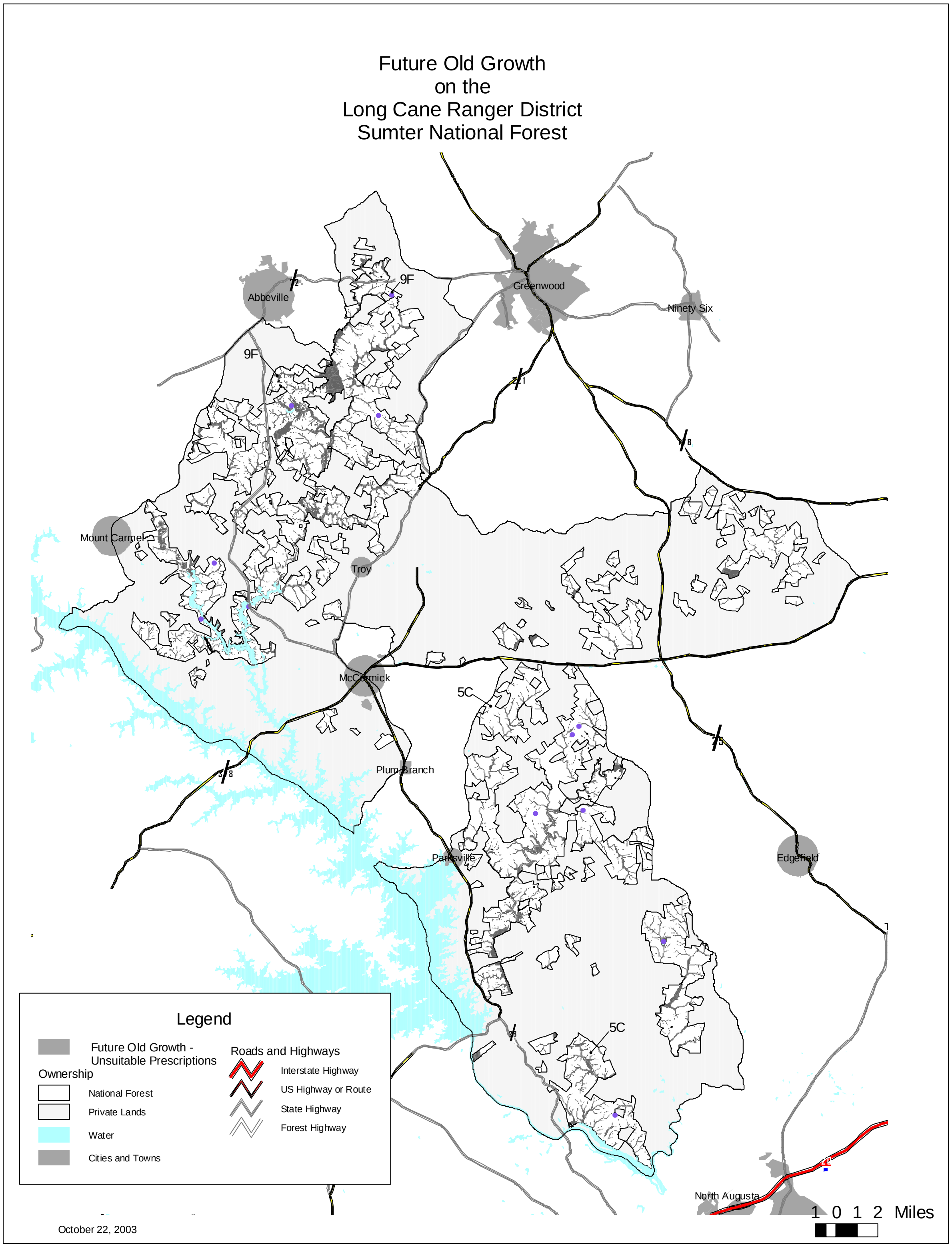
Table 3-42. Total Forested Acres by Old Growth Community Type and Ecological Section for the Sumter National Forest

Community Type Number	**Community Type**	**Blue Ridge** (acres)	**Piedmont** (acres)
2/5	Conifer/northern hardwood & mixed mesophytic	19,770	1,820
13/28	River floodplain & eastern riverfront forests	-	28,350
21	Dry-mesic oak forest	15,070	29,810
22/24	Dry-xeric forest, woodland, savanna	1,723	1,700
25	Dry-mesic oak-pine & pine-oak	34,890	2,240
NA	Loblolly pine	6,850	181,450*
TOTAL		**78,280**	**245,394**

Source: *Plan revision CISC data, base year 2002 *99.8% loblolly pine, the rest other pines*


Future Old Growth
on the
Andrew Pickens Ranger District
Sumter National Forest
Salem
Walhalla
Westminster
Seneca
28
76
Legend
Future Old Growth - Unsuitable Prescriptions
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003


Future Old Growth
on the
Enoree District
Sumter National Forest
Union
72
Whitmire
4F
Joanna
ewberry
Legend
Future Old Growth -
Unsuitable Prescriptions
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003


Future Old Growth
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
Greenwood
Ninety Six
9F
9F
Mount Carmel
Troy
McCormick
5C
Plum Branch
Parksville
Edgefield
5C
North Augusta
Legend
Future Old Growth - Unsuitable Prescriptions
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003

Direct and Indirect Effects

Consistent with goal 11 in the proposed forest plan, the forest will provide for a network of small, medium, and large-sized patches of old growth (old growth report, p.16). Allocations for medium and large-sized old growth patches are provided through the allocation of "old growth compatible management prescriptions" (Table 3-43). Maps of these prescriptions are included in the process record. For the purposes of this analysis, we included those management prescriptions that are classified as "unsuitable" for timber production. Unsuitable land is not scheduled for regular timber harvest, and although vegetation management can occur, it is done for reasons other than to supply timber to local economies. It is assumed that in these areas, management could occur in association with trail maintenance, hazard tree removal, or wildlife, fish, or plant community restoration work on up to 10% of the area. Prescribed burning and the cutting of living vegetation may occur when consistent with the desired condition and associated prescription or management-level objectives or standards.

The following management prescriptions applied on the Sumter National Forest were included in the analysis as old growth compatible management prescriptions:

Table 3-43 Old Growth and Old Growth Compatible Management Prescriptions Across All Alternatives for the Sumter National Forest.

Mgmt Rx No.	Management Prescription Name
1.A.	Congressionally-designated Wilderness Area
1.B.	Recommended to Congress for Wilderness Study
2.A.1	Congressionally-designated Wild Segment of Wild & Scenic River System
2.A.2	Congressionally-designated Scenic Segment of Wild & Scenic River System
2.A.3	Congressionally-designated Recreational Segment of Wild & Scenic River System
2.B.1	Recommended to Congress for Designation as a Wild Segment of the Wild & Scenic River System
2.B.2	Recommended to Congress for Designation as a Wild Segment of the Wild & Scenic River System
2.B.3	Recommended to Congress for Designation as a Recreational Segment of the Wild & Scenic River System
4.D.	Botanical-Zoological Areas
4.F.	Scenic Areas
6.A.	Old Growth with Natural Process Emphasis
6.B.	Areas Managed to Restore/Maintain Old Growth Characteristics
6.C	Old Growth Areas Managed With a Mix of Natural Processes & Restoration
6.D	Core Areas of Old Growth Surrounded by Areas with Extended Even-Aged Management
6.E	Core Areas of Old Growth Surrounded by Areas under Uneven-aged Management
7.E.1	Dispersed Recreation – Unsuitable Land

9.F.	Rare Communities
11	Riparian Corridors
12.A.	Remote Backcountry Recreation – Few Roads
12.B	Remote Backcountry Recreation – Non-Motorized

Based on the relative abundance of old growth compatible prescriptions, it is anticipated that future old growth on the Sumter National Forest will be provided in the following proportions within medium and large-sized patches based on the following two tables (Tables 3-44 and 3-45).

Table 3-44. Acres Allocated to Old Growth Compatible Prescriptions by Alternative and by Community Type on the Sumter NF, Andrew Pickens Ranger District

Type#	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F	Alt. G	Alt. I
2/5	13,560	12,600	8660	11,160	4620	17,220	12,813
13/28	-	-	-	-	-	-	-
21	9100	8500	11,160	8,950	2,770	14,770	9,029
22/24	860	750	320	910	32	3,180	657
25	34,890	15,630	11,790	6470	6470	34,810	13,986
Loblolly Pine	6850	1910	860	240	240	6,850	743
Total Acres Allocated	33,120	31,280	19,105	35,170	14,120	66,690	37,228

Table 3-45. Acres Allocated to Old Growth Compatible Prescriptions by Alternative and by Community Type on the Sumter NF, Piedmont Districts

Type#	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F	Alt. G	Alt. I
2/5	890	860	890	950	60	990	842
13/28	20,160	21,800	20,310	21,180	890	21,410	20,735
21	11,170	14,840	11,650	13,480	1120	12,760	11,553
22/24	580	650	580	600	-	600	533
25	640	1560	640	920	3	1690	863
Pine	21,370	45,270	23,970	48,790	1300	43,920	24,012
Total Acres Allocated	54,820	84,980	58,050	85,930	3,400	81,360	58,538

The tables above suggest that old growth is adequately represented across old growth community types, in proportion to their relative abundance at this time, particularly on the Andrew Pickens. However, several community types, including xeric oak and shortleaf pine woodlands and dry-mesic oak forests or woodlands, are much more rare

today than they were prior to Forest Service acquisition. Forestwide objectives to restore woodlands and shortleaf pine communities and to promote oak regeneration on the piedmont, address the restoration of community types which are relatively uncommon through management prescriptions which allow more active management.

The possible old growth inventory was not ground-truthed, but was considered in the allocation of management prescriptions conducive to maintaining or restoring old growth conditions. Based on a forestwide standard common to all alternatives, existing old growth, when encountered, will be managed to protect the old growth characteristics. Site-specific inventories will be conducted prior to the implementation of projects that have the potential to affect them. This standard applies equally to all alternatives and with this standard in place, there is no anticipated direct loss through the management of small patches of existing old growth stands in any alternative.

Indirect effects to small patches of old growth, including those associated with the invasion of non-native species, could occur as a result of management activities occurring adjacent to these patches. Other indirect effects could result from the invasion of forest pests such as southern pine beetle, hemlock woolly adelgid, or oak decline. These will be addressed at the project level as needed to ensure that the old growth values are protected.

Cumulative Effects

The cumulative effects associated with the allocation of old growth include economic effects, including effects to local economies which rely on the supply of timber from the national forests, social effects, and biological effects. The supply of old growth conditions on private lands is likely to decline in the future as population centers continue to expand, suggesting that the national forests will provide a large role in creating and maintaining these areas in future, especially for recreationists. Large trees create a special place for people who come to the national forest to view nature and escape urbanization. The demand placed on older forests for timber will continue to grow as well, as human populations grow and the demand for wood products continues to increase. Few or no “old growth” obligate species are known from the Sumter National Forest though many prefer older forests. Alternative I provides for 26% of the forested acres in management prescriptions conducive to creating or maintaining old growth conditions, and all alternatives, with the exception of current management (Alternative F), contain standards which will protect existing old growth when it is encountered on the forest as a result of site-specific inventories. Therefore, it is determined that implementation of all alternatives (with the exception of alternative F) will meet the intent of the old growth report in providing for a network of small, medium, and large-sized patches of old growth. Alternative I, by containing forestwide objectives to restore woodlands, shortleaf pine, and oak-dominated hardwood communities, will go further to encourage the development of communities that are less common than they were prior to Forest Service acquisition.

Terrestrial Habitat Elements

Riparian

Affected Environment

This section focuses on terrestrial habitat aspects of riparian areas; aquatic aspects of these ecologically important areas are covered under assessment of watersheds and aquatic systems.

Terrestrial riparian habitats encompass the transition area between aquatic systems and upland terrestrial systems. All wetlands (including beaver ponds), as well as margins of varying widths along streams, rivers, lakes, ponds, and reservoirs, are contained within terrestrial riparian habitats. These areas provide a number of critical functions for associated species. Most importantly, they provide rich, moist environments not often found in upland areas. Riparian terrestrial habitats may serve as corridors for wildlife movement, allowing for daily travel and seasonal migration. The riparian area may serve as a connector of habitats and populations allowing gene flow to occur, thus keeping populations genetically vigorous (Harris 1988).

Riparian habitats ideally include a mosaic of native plant and animal communities and successional stages, with a predominance of late-successional forests. Late-successional riparian forests contain multiple canopy layers that provide a variety of ecological niches, thermal and protective cover, and maintenance of moist conditions. Decadence of older forests provides an abundance of snags and downed wood, which also helps retain moisture and provides important habitat substrate for reptiles, amphibians, small mammals, invertebrates, and mosses and liverworts. The majority of riparian dependent species need or prefer late-successional forest conditions for the diverse structure and the moist, temperature-moderated microclimates they provide. However, some species require early-successional or shrubby riparian habitats.

Disturbance regimes in riparian areas differ from those of adjacent uplands in important ways. Sheltered topographic positions and moist conditions generally reduce disturbance caused by wind and fire. Disturbance sources more common in riparian areas are beaver activity and flooding and channel scour, especially along stream banks. These operate in addition to more universal factors such as insect and disease outbreaks. One of the most important disturbance factors in riparian areas for at least the past thousand years is anthropogenic clearing, which, even prior to European settlement, was sufficient to create large areas of early-successional riparian habitats such as canebrakes (Brantley and Platt 2001). Concentration of anthropogenic disturbances in riparian habitats was the result of the high fertility and level terrain of these areas. Such effects were likely most predominant along larger streams and rivers. Today, these same factors continue to drive anthropogenic disturbance in these areas. The value of these areas for human uses has resulted in many riparian zones along major watercourses remaining in private ownership while upper reaches were converted to public ownership. Prior to European settlement,

anthropogenic disturbance along smaller streams, which are more typical of national forest lands, was likely less extensive, resulting in a greater predominance of late-successional conditions in these riparian areas. The challenge for federal land managers today is to try to restore, to the extent possible, the network of mature forest riparian corridors critical to many species and to water quality, while providing some level of quality habitats for those species adapted to early-sucessional riparian habitats.

The Southern Appalachian Assessment (SAA SAMAB 1996) included analysis of cover classes within 100 feet of watercourses for the entire study area. Satellite data with 30-meter resolution were used, resulting in only larger watercourses being detected. The 100-foot corridor width was selected due to the precision of the database and because riparian corridors of 100-160 feet can be useful for correlation of the riparian landscape to stream habitat and biological integrity (SAMAB 1996: 72). Based on this analysis, within the SAA study area there are approximately 2.3 million acres in the riparian zone. Land cover classes for the riparian study area were: 70% forested, 22% pasture/herbaceous, 3% cropland, 4.3% developed/barren, and 0.7% wetland. Ownership of land in the riparian zone in the SAA area is mainly private, approximately 85%, with national forests being the next major owner at approximately 10%. The remaining 5% is in national parks, the Cherokee Indians' ownership, other federal holdings, and state parks and forests (SAMAB 1996:71-74).

Riparian forest cover varied across the study area from more than 90% to less than 25%, with the Ridge and Valley ecoregion tending to have less forest cover in the riparian zone than the Blue Ridge and other ecoregions. The analysis also found that "[l]ands in federal ownership, such as national forests and national parks, have significantly more forest cover in the riparian zone than do lands in other ownerships."

On the Sumter National Forest there are approximately 67,000 acres associated with the riparian corridor (Tables 3-46 and 3-47). This represents nearly 20% of the national forest. Riparian areas, which are recognized by a combination of soil, vegetation, and hydrologic characteristics, are a part of the riparian corridor.

Table 3-46. Current acreage (m acres) in the riparian corridor by community type and successional stage in the mountains on the Sumter National Forest, 2002.

Community Type	Successional Stage				
	Early	Sapling/ Pole	Mid	Late	Total
Conifer-Northern Hardwood Forest, Mixed Mesophytic Forest, River Floodplain Hardwood Forest, Eastern Riverfront Forest	<0.1	0.5	0.5	1.3	2.3
Dry-Mesic Oak Forest	<0.1	0.3	0.7	1.8	2.9
Pine Types	<0.1	0.2	0.9	2.6	3.8
TOTAL	0.2	1.1	2.1	5.6	9.0

Table 3-47. Current acreage (m acres) in the riparian corridor by community type and successional stage in the piedmont on the Sumter National Forest, 2002.

Community Type	Successional Stage				
	Early	Sapling/ Pole	Mid	Late	Total
Conifer-Northern Hardwood Forest, Mixed Mesophytic Forest, River Floodplain Hardwood Forest, Eastern Riverfront Forest	<0.1	0.5	2.1	17.8	20.4
Dry-Mesic Oak Forest	1.3	3.8	6.0	9.0	20.1
Pine and Pine-Oak Types	<0.1	6.5	6.5	3.9	17
TOTAL	1.4	10.8	14.6	30.7	57.5

Many terrestrial species of viability concern are associated with riparian habitats (Appendix F). Most are associated with late-successional riparian forests, but some require the dense understories that result from open canopy or early-successional conditions.

The primary indicator used to assess terrestrial habitat conditions within riparian areas is forestwide acreage of riparian corridors by successional stage. The Acadian flycatcher (*Empidonax virescens*) is selected as an appropriate management indicator species for mid- and late-successional riparian forest habitat. It requires deciduous forest near streams for breeding and is not often found outside of these habitats during the breeding season (Hamel 1992:193). Its presence indicates riparian forests with relatively high

levels of canopy cover and low levels of management disturbance – conditions required or preferred by many riparian associated species. Two species, the American woodcock *(Scolopax minor)* and the Swanison's warbler *(Limnothlypis swainsonnii)* are selected as indicator species for early successional riparian forests. Swanison's warbler require high stem densities with little to no ground cover which represent conditions preferred by another suite of riparian associated species. Swainson's warbler (a summer resident) currently are incidental in the Piedmont and found in low numbers on the Andrew Pickens District. American woodcock requires shrubby cover, relatively open overstory conditions, high stem densities and fertile soils with an abundance of earthworms. American woodcock (a winter resident and occasional summer breeder) populations fluctuate widely and are known to occur in low numbers throughout the Sumter National Forest. Population trends for these species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest. In addition American woodcock can be counted during breeding and migration periods.

Direct and Indirect Effects

Under all alternatives, riparian corridors are managed under the riparian prescription. The prescription defines these corridors by setting minimum widths of 100 feet on either side of perennial streams and 50 feet on either side of intermittent streams, but also indicates that these corridors "should be expanded to include all of the true riparian area." The management goal for riparian corridors is to maintain or enhance the structural and functional integrity of riparian areas and associated aquatic and upland systems. Riparian corridor characteristics important to structural and functional integrity for terrestrial wildlife include habitat connectivity; vegetation diversity (including age, species composition, and vegetation layer diversity), vegetation vigor, abundance of snags and woody debris, and a width that is adequate to retain riparian habitat functions (Knutson and Naef 1997). Riparian corridors include the concept of buffering streams to retain important stream functions, but they also encompass the functional aspects of riparian areas relative to uplands. Therefore, they present the opportunity to manage riparian habitat as a more completely functioning system in which streams and uplands mutually influence each other (Knutson and Naef 1997; Tiner 1999).

To provide for riparian integrity, management standards are included in the riparian prescription. These include provisions to provide desirable levels of woody debris and controls on impacts from grazing, recreational uses, mineral development, and fire line construction. Vegetation management is limited to that needed to maintain or improve riparian function or to provide a continual supply of habitat for riparian associated species. Zones around channeled ephemeral streams are also recognized as part of the riparian prescription area, with standards designed to ensure protection of channels and their function as part of the riparian network.

Forestwide objectives for canebrake restoration, creation of early-successional riparian forests, and creation of canopy gaps to increase structural diversity in closed canopy riparian forests are included in the draft revised plan to provide for community diversity

where needed within riparian areas. These activities represent the vegetation management activities most likely to be implemented in riparian corridors. Levels of these activities would vary across alternatives (Table 3-48), affect only a small proportion of the riparian corridor, and would be implemented where such conditions are lacking. Prescribed fire also may occur within riparian corridors, most often as low intensity backing fires as necessary to use streams as control lines. Because of their low intensity, these fires are not expected to substantially alter vegetation or leaf litter conditions. Where riparian corridors support fire-dependent communities (e.g., canebrakes), prescribed fire may be used more purposefully to periodically maintain these communities.

Table 3-48. Expected levels of vegetation management activity (m acres) within riparian corridors for the purpose of providing vegetation diversity for riparian dependent biota, by forest plan revision alternative, Sumter National Forest.

	Alternative						
Management Activity	A	B	D	E	F	G	I
Acres of Canebrake Restored in 10 Years of Plan Implementation	0.1	0.2	0.1	0.1	0.1	0.1	0.2
Acres of Canopy Gap Treatments in 10 Years of Plan Implementation	1.0	5.0	1.0	5.0	0	0	3.0
Percent of forestwide riparian corridors maintained in early successional habitats in 10 years of Plan implementation	1.5 – 3.7%	0.9-1.9%	1.8-4.4%	1-2.5%	n/a	0.3-1.4%	1.2-2.7%

Implementation of the riparian prescription under all alternatives is expected to increase the acreage within riparian corridors that is in late-successional forest (Tables 3-50 and 3-51) as a result of allowing forests in these areas to age. Increases in older forests would result in increases in abundance of snags and downed wood, important habitat components for many riparian dependent species. It would also result in abundant and well-distributed habitats characterized by shaded, low-disturbance, moist-soil microsites, which are preferred habitat for other species. Small amounts of the riparian corridor would be intentionally set back in succession to create breeding, stop-over, or wintering habitat for riparian associated species. Small amounts of cane dominated sites (canebrakes) and wetlands (moist soil to shallow water habitats) would also be restored. Some sites would be thinned or harvested to improve structural diversity, mast production, or restore plant communities to species found in bottomland or riverfront forest. Overall, trends are expected to create a distribution of some early but predominantly late-successional forest within the riparian corridor (Tables 3-49, 3-50, 3-51). Patches of created early-successional habitat are not expected to diminish the role of riparian areas as landscape corridors because of their small size and relative rarity, and their occurrence within a predominately mature forest matrix.

Table 3-49. Expected percent of riparian acreage in early-successional forest conditions on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	1.5	3.7	1.5	3.7
Alternative B	0.9	1.9	0.9	1.9
Alternative D	1.8	4.4	1.8	4.4
Alternative E	1.0	2.5	1.0	2.5
Alternative F	n/a	n/a	n/a	n/a
Alternative G	0.3	1.4	0.3	1.4
Alternative I	1.2	2.7	1.2	2.7

Table 3-50. Expected percent of riparian acreage in mid- and late--successional forest conditions on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	>92	>83	>92	>83
Alternative B	>88	>84	>88	>84
Alternative D	>91	>80	>91	>80
Alternative E	>88	>82	>88	>82
Alternative F	n/a	n/a	n/a	n/a
Alternative G	>98	>94	>98	>94
Alternative I	>90	>84	>90	>84

Table 3-51. Expected percent of riparian acreage in late-successional forest on the Sumter National Forest, after 10 and 50 years of implementing forest plan alternatives. (derived from SPECTRUM models)

	Mountains		Piedmont	
Alternative	Year 10	Year 50	Year 10	Year 50
Alternative A	>67	>72	>63	>74
Alternative B	>63	>73	>60	>74
Alternative D	>67	>51	>65	>71
Alternative E	>63	>71	>59	>73
Alternative F	n/a	n/a	n/a	n/a
Alternative G	>71	>82	>66	>83
Alternative I	>65	>73	>61	>74

Many species – beaver, raccoon, muskrat, wood duck, colonial nesting birds, bald eagle, wood stork, osprey, kingfisher, water thrush, wading birds, turtles, salamanders, and frogs would benefit most from Alternatives B, E and I. For the Acadian flycatcher, the direct and indirect effect of all alternatives would be positive. Analysis indicates that, under all alternatives, in 50 years the riparian corridors would move toward the desired condition for the Acadian flycatcher, i.e., mature to older-aged forests. Acadian flycatcher populations are expected to follow trends in mature riparian forest due to the close association between this species and habitat type. Breeding densities in suitable

habitat average 14.5 pairs per 100 acres, with high densities reaching 43 pairs per 100 acres (Hamel 1990: C-5). Population trends for this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Cumulative Effects

Cumulatively, networks of riparian corridors across landscapes containing National Forest System land in South Carolina have been fragmented by mixed ownerships and land use conversion. This condition is expected to persist across all alternatives into the foreseeable future.

Alteration of riparian areas from conditions needed to support dependent species is most prevalent along larger rivers and streams, which (except for the Chattooga River) are disproportionately under private ownership. Historically these sites likely provided the best quality habitat for riparian dependent species and an especially large proportion of the landscape's early-successional riparian component due to their use for Native American agriculture. Today, these sites on private land are likely to provide large expanses of open conditions in the riparian habitat due to private land management actions, but it is more likely to be cultivated ground or improved pastureland and habitat quality cannot be assumed. Many of the riparian areas in these land-uses are no longer suitable for either early- or late-successional riparian dependent or associated species.

It is not expected that private landowners will restore or manage to maintain significant amounts of high quality riparian habitats, including canebrakes or wetland habitats, and they would remain limited in abundance on the landscape without national forest maintenance and establishment efforts. Expected trends for riparian areas on national forest land – moving toward mature forest dominance with a small component maintained in early-successional habitat and development of wetland complexes along river corridors – would contribute to sustaining breeding, migratory, and wintering populations of riparian dependent or associated species on the landscape.

Snags, Dens, and Downed Wood

Affected Environment

Large woody debris (including branches, large logs, stumps, and root wads) is an important habitat component both to streams and terrestrial areas. It is important both structurally and as a source of nutrients.

Large snags provide birds with nesting and feeding sites, singing perches, and as lookout posts for predators and prey (Howard and Allen 1988). Bats roost and produce maternity colonies under exfoliating bark. Amphibians, reptiles, small mammals, and invertebrates utilize woody debris as cover. Animals use snags, logs, and stumps as denning sites.

Downed wood and logs are used for drumming by grouse to attract mates. Turtles and snakes use logs in streams and overhanging branches for basking and sunning. Large woody debris in riparian areas is used as cover by amphibians, insects and other invertebrates, and small mammals. Small mammals utilize logs as travel ways. Fungi and other decomposers of woody debris are key components of food webs. Rotting wood tends to absorb moisture during wet periods and release it in dry periods, thus helping to maintain a cooler microclimate (Ernst and Brown 1988; Knutson and Naef 1997).

Within the stream system, downed wood from riparian trees and shrubs greatly influences channel morphology and aquatic ecology. By obstructing streamflow, large woody debris stores and distributes sediment and creates channel features such as pools, riffles, and waterfalls. Wood also traps organic matter, which allows this material to be processed by instream organisms. Fish and insects occupy the pools and riffles created by the large woody debris, and riparian forest regeneration occurs on deposited sediment (Lassettre and Harris 2001).

Den trees, defined as living trees with hollows or cavities inhabited by animals, also are a critical habitat component for many species. They are used for nesting, roosting and hibernating. Many species of potential viability concern are associated with snags, downed wood, or den trees (Appendix F). Hunter (1990) states that little information is available on how much large woody material is sufficient to support associated species. He cites literature that reviews expert opinion on snags, with a recommendation of 2-4 snags per acre being a "reasonable target."

With the exception of the large amount of small diameter dead and decaying wood in sapling/pole stands, snags and downed wood are typically most abundant in late-successional forests. Current abundance of late-successional forest by community type is shown under the section on successional forests. Snags and downed wood also may be abundant in forests affected by mortality events such as storms and insect and disease outbreaks. Fire may reduce snags and downed wood in fire-dependent communities, but is also known to cause some tree mortality, which in turn creates new snags and eventually, downed wood. Alternatives vary by the amount and frequency of prescribed burning opportunities (Tables 3-52 and 3-53).

Table 3-52. Estimated average annual acres (m acres) of prescribed burning by alternative and plant community (mountains)

MOUNTAINS

Community Type	Fire return interval (years)	A	B	D	E	F	G	I
Dry-Mesic Oak	10 to 35	0.5	1.0	0.5	1.4	0.9	0.5	1.0
Dry and Xeric Oak	3 to 10	0.3	1.0	0.2	0.8	0.2	0.2	0.5
Shortleaf Pine/Pitch Pine/Pine-Oak (all mixed types)	2 to 10	2.5	4.5	2.2	3.5	1.0	1.1	3.6
Loblolly Pine-Oak (Dry & Dry-Mesic Oak-Pine in part)	10 to 35	1.6	2.6	1.8	2.6	1.9	0.9	1.7
Table Mountain Pine (Pine & Pine-Oak in Part)	6 to 10	0.3	0.3	0.2	0.3	0.3	0.2	0.3
Mountain Longleaf Pine (Pine & Pine-Oak in Part)	6 to 10	<0.1	0.1	<0.1	<0.1	0.1	<0.1	0.1
Grass Dominated communities	2 to 10	0.5	0.4	0.1	0.6	0.1	851	4002
Total **Average Annual**	-----	**5.6**	**9.6**	**5.0**	**9.3**	**4.5**	**2.9**	**7.4**

Table 3-53. Estimated average annual acres (m acres) of prescribed burning by alternative and plant community (Piedmont)

PIEDMONT

Community Type	Fire return interval (years)	A	B	D	E	F	G	I
Dry-Mesic Oak	10 to 35	0.8	1.6	0.8	2.5	1.7	0.8	1.7
Dry and Xeric Oak	3 to 10	0.3	0.4	0.5	1.3	0.3	0.3	0.8
Shortleaf Pine/Pitch Pine/Pine-Oak (all mixed types)	2 to 10	0.6	2.2	1.3	1.3	0.3	0.3	1.3
Loblolly Pine-Oak (Dry & Dry-Mesic Oak-Pine in part)	10 to 35	12	18	11	18	12	5.8	12
Grass Dominated communities	2 to 10	0.4	1.6	1.0	1.2	0.7	0.2	0.6
Total **Average Annual**	-----	**14.0**	**23.4**	**15.1**	**23.9**	**14.9**	**7.5**	**16.1**

Acres in late-successional forest conditions are one indicator of the presence of these habitat elements because of their relative abundance in this successional stage. The pileated woodpecker (*Drycopus pileatus*) is selected as the wildlife management indicator species for snags, dens, and downed wood. It requires large cavity trees for nesting and forages on dead trees and downed logs across a variety of community types (Hamel 1992:190). Population trends of this species are tracked by annual breeding bird surveys (BBS) and bird point counts conducted on the Sumter National Forest.

Direct and Indirect Effects

Forestwide direction under all alternatives states that unless necessary for insect or disease control or to provide for public and employee safety, standing snags and den trees would not be cut or bulldozed during vegetation management treatments unrelated to timber salvage. For timber salvage treatments, all live den trees and existing snags (up to 5 per acre from the largest size classes) would be retained. Distribution of snags and live residuals may be scattered or clumped. Live den trees would not be used for snag creation, but could count toward live residuals.

Forestwide direction for potential black bear den trees under all alternatives states that den trees would be left during all vegetation management treatments occurring in habitats suitable for bears (Andrew Pickens District only). Potential den trees are greater than 20 inches DBH and hollow.

With these provisions included under all alternatives, existing snags, downed wood, and den trees would be well maintained on Sumter National Forest land. It is reasonable to predict that with these management provisions combined with the continuous creation of more habitat through aging age-class distributions, most alternatives (except for possibly A, D, and F) will result in an increasing abundance and improved distribution of these habitat elements over the next 50 years. Increased mortality of trees due to forest health threats potentially would increase abundance of snags and downed wood regardless of management approaches (see cumulative effects discussion below). Den trees are also expected to increase in abundance as forests age. However, restoring an abundance of large diameter den trees will require several decades of forest growth in many forest community types found in the Blue Ridge and Piedmont physiographic areas.

Because of their dependence on large snags for nest sites, pileated woodpecker populations are expected to follow trends in snag availability and persistence on the forest. Population trends, therefore, should be positive under all alternatives.

Cumulative Effects

In the Piedmont of South Carolina, national forest lands are expected to provide a disproportionately large share of high quality habitats for species associated with snags, downed wood, and den trees. This result is expected because of the distribution of older forests on national forest compared to private lands (see section on Mix of Early and Late Successional Forests). This disparity is expected to increase over time as other land uses and market conditions for forest products affect the age, composition and structure of forests on private lands.

Forest health threats also are expected to substantially add to cumulative effects on these habitat elements, by increasing tree mortality. The increasing number of biological threats and increasing severity of effects in recent years has created an abundance of snags and downed wood in many locations across the Sumter National Forest. This trend is expected to continue into the foreseeable future as forests age and biological threats expand their zone of influence (see section on Forest Health). While national forest management can reduce the severity of tree mortality in some locations, forest health threats are nevertheless expected to have a substantially positive effect on abundance and distribution of snags and downed wood under all alternatives. Den trees, which generally need longevity to become high quality habitat elements for wildlife, are likely to be negatively affected by forest health threats.

Watersheds and Aquatic Habitats

Affected Environment

On the Forest, the Andrew Pickens Ranger District contains portions of seven 5th level watersheds that drain to the Savannah River. These include the Chattooga River, Chauga River, Coneross Creek, Upper Keowee Composite, Little River Composite, Tugaloo River Composite and Whitewater River Composite. Forest Service ownership is greatest within the Chauga and Little River watersheds at 42% and 16% respectively. There are 4,426 stream kilometers (2,751 miles) on the District. Ownership is disjunct with private inholdings throughout the watersheds. The majority of the streams are classified as cool water habitats, with headwaters consisting of cold-water fish species. Approximately 49 species of fish occur among these watersheds. Forest sensitive species include one mussel and one crayfish

The Enoree Ranger District in the Piedmont contains portions of fourteen 5th level watersheds that are within the Santee-Cooper drainage. These include Upper Broad River Composite, Browns Creek, Sandy River, Lower Broad River Composite, Little River, Middle Tyger River Composite, Fairforest Creek, Lower Tyger River Composite, Middle Enoree River Composite, Duncan Creek, Indian Creek, Lower Enoree River Composite and Middle Saluda River Composite. The Lower Broad River Composite, Middle Tyger River Composite, Lower Tyger River Composite, Middle Enoree River Composite and Lower Enoree River Composite watersheds were rated as high vulnerability in a conservation assessment of National Forests for the Southern Region (McDougal 2001). The high vulnerability rating for these watersheds is associated with a mixture of factors including rare species composition; high human population increase; and medium public interest. Forest ownership is greatest within the Indian Creek and Lower Enoree River Composite watersheds at 48% and 44% respectively. Ownership is disjunct with private inholdings throughout the watersheds. This pattern of ownership is typical throughout the District. There are 8,576 kilometers (5,330 miles) of streams on the District. All of the streams are classified as warm water habitats. There are approximately 54 species of fish that occur in these watersheds; one classified as a Forest sensitive species.

The Long Cane Ranger District is also located in the Piedmont. It contains portions of seven 5th level watersheds that drain to the Savannah River. These include Little River Composite, Little River, Long Cane Creek, Lower Savannah Composite, Upper Stevens Creek, Turkey Creek and Lower Stevens Creek Composite. The Upper and Lower Stevens Creek watersheds were rated as high vulnerability in a conservation assessment of national forests for the southern region (McDougal, 2001). Forest Service ownership is greatest in the Lower Savannah Composite at 30% and Long Cane Creek at 27%. Ownership is disjunct with private inholdings throughout the watersheds. This pattern of ownership is typical throughout the District. There are 6,840 kilometers (4,252 miles) of streams on the District. All of the streams are classified as warm water habitats. The Upper Stephens Creek and Turkey Creek watersheds contain the richest diversity of

mussel species on the Forest, including one federally listed species. There are approximately 39 species of fish located in all the watersheds; one classified as a Forest sensitive species.

There are 34 hectares (85 acres) of warm water pond and small lake habitat located on the Forest across the three districts. These waters are managed for recreational fishing opportunities.

Federally listed and Forest Service sensitive species that occur on or near the Forest are listed in Table 3-54. These species have been addressed in the EIS Aquatic Viability Analysis (Chapter 3).

Table 3-54. Federally listed threatened (T) and endangered (E) aquatic species and Forest Service sensitive (S) aquatic species on the Sumter National Forest.

Scientific Name	Common Name	Status
Alasmidonta varicosa	Brook floater	S
Cambarus chaugaensis	Oconee stream crayfish	S
Etheostoma collis	Carolina darter	S
Lampsilis splendida	Rayed pink fatmucket	S
Lasmigona decorata	Carolina heelsplitter	E

Management Indicator Species are addressed in the MIS Process Record. Changes in aquatic communities will be used to assess Forest management activities on the aquatic ecosystem. Fish populations are monitored on a rotational basis across the Forest in cold, cool, and warm water stream habitats. Species composition and abundance reflect changes that may occur in stream populations. In addition, the aquatic insect community will be used as a monitoring tool to determine management activity effects on stream systems. Warm water pond habitats are monitored on an annual basis for the purpose of managing a recreational fishery for the public.

Direct and Indirect Effects

Soil disturbance and loss of riparian vegetation remain the largest threats to aquatic habitats in watersheds of the Sumter National Forest. Soil disturbance adds sediments to streams that were highly impacted by past farming and logging practices. Road and trail crossings contribute sediments to streams and can inhibit the movement of aquatic organisms within the stream system. Loss of riparian vegetation compromises large woody debris and leaf litter contribution to the aquatic system, shading for stream temperature maintenance, and the filtering capacity of the riparian area for sediments.

The Riparian Corridor Prescription, (Appendix C) which addresses perennial and intermittent streams, and the Forest Wide Standards (Chapter 2 FW-4 through FW-14) specific to ephemeral channels should mitigate most direct and indirect effects associated

with aquatic resources across all action Alternatives. Riparian corridor mapping will occur on a site-specific basis and will address aquatic habitat improvement needs. Implementation of guidelines associated with the riparian corridor should further minimize effects of land management activities. Where recreation and timber prescriptions are emphasized in alternatives, the number of road and trail stream crossings may increase. Any direct or indirect effects from these activities should be short term and may impact individuals, but should not affect aquatic populations. Harvest within the riparian area for canopy gap associated wildlife habitat, waterbird habitat development and canebreak restoration comprise 5,600 acres, or 10 percent of riparian area across the Forest under Alternative I. The total acreage for these activities increase for Alternatives B and E for canopy gaps, Alternative E for waterbird habitat development and Alternatives B and G for canebreak restoration. The total acreages decrease for Alternatives A, D and G. These activities have the potential of impacting aquatic resources through soil and vegetation disturbance and fish passage barriers. All these activities will be analyzed and mitigated on a site-specific basis.

The Riparian Corridor Prescription is a component of all action alternatives. Riparian areas and aquatic resources are managed to encourage the processes that maintain or lead to a desired future condition for fisheries and aquatic habitats. Riparian habitats and fisheries are sustained in a healthy condition. Soil disturbance is minimized and road and trail crossings are maintained to protect aquatic resources and allow movement of aquatic species in the stream system. Vegetation management occurs only when needed to protect or enhance riparian-associated resources. Large woody debris input increases stream habitat diversity as riparian vegetation matures. Current management practices such as aquatic species stocking and restoration and habitat improvement and enhancement may be suitable. These practices incorporate low soil disturbance activities and any negative effects should be minimal impact and short term. Implementation of the Riparian Corridor Prescription should have beneficial effects on aquatic resources.

Other prescriptions associated with action alternatives have the potential to affect fisheries management. For those alternatives that propose additional recommended wilderness study area acreage (Chapter 3, Prescription 1B), there should be no effect on trout management in watersheds of the Andrew Pickens Ranger District. The Wilderness Management Handbook (Exhibit 1-9) states that species of fish traditionally stocked before wilderness designation may be considered indigenous if the species is likely to survive. The SC Department of Natural Resources will continue to stock trout species in these waters.

Cumulative Effects

Direct and indirect adverse effects to aquatic communities are minimized by the Riparian Corridor Prescription and Forest Wide Watershed standards; however, they are not eliminated from the entire watershed. Cumulatively, Forest Service activities may contribute to sediment in the watershed.

Clingenpeel (2002) developed a process to estimate sediment yield and analyze the cumulative effects of proposed management actions on water quality and aquatic species viability at the 5th level watershed scale. The process predicts sediment yields as a surrogate for determining cumulative impacts to water quality and specifies a Watershed Condition Rank (WCR) for each of the 28 5th level watersheds under each of the seven alternatives (Table 2). The WCR is at a scale that does not reflect the mitigation effects of Riparian Corridor Prescription implementation. The WCR in each watershed was consistent for all seven alternatives. Possible Watershed Health Indices are Excellent, Average, and Below Average. Forest objectives are determined by the WCR and their related potentials for affecting aquatic resources.

If the WCR is scored Excellent (E), the probability is low for adverse effects to aquatic resources. Excellent watershed objectives are to maintain or improve aquatic health through the implementation of the Riparian Corridor Prescription. On the Sumter National Forest, four watersheds are ranked as Excellent. Average (A) denotes the potential to adversely affect aquatic resources as moderate. In addition to maintaining and improving aquatic health, objectives for Average watersheds include conducting watershed assessments at the project level and pre-project monitoring efforts to determine actual biota health. Twenty 5th level watersheds have a WCR of Average on the Sumter National Forest. Where a watershed WCR is below average (BA), the potential to adversely affect aquatic resources is high In addition to the objectives stated for Excellent and Average watersheds, the focus in Below Average watersheds include maintaining and restoring watershed health and aquatic systems on a project level, where the Forest Service can make meaningful contributions to the watershed health. Opportunities may include partnerships with other landowners to improve overall watershed condition. Four watersheds were assigned a Below Average index in this process.

Plan management direction is to maintain, restore, and enhance riparian and aquatic habitat. The Riparian Corridor Prescription addressing perennial and intermittent streams and the Forest Wide Standards specific to ephemeral channels will be implemented across all action Alternatives. Watersheds with an Excellent WCR score remain Excellent for all action alternatives, and therefore there should be no adverse cumulative effects on water quality with respect to aquatic resources for those watersheds. Watersheds with Average and Below Average WCR scores also remain Average and Below Average across all action alternatives. For these watersheds, additional watershed assessments and surveys should be conducted to determine the sources of impairment and prescribe appropriate treatments when they occur on National Forest lands. As a result, no additional adverse effects to water quality or aquaitc species should occur.

Table 3-55. Watershed condition for forest plan alternatives on the Sumter National Forest (period-1). Ownership is the percentage of the watershed managed by the SNF. Current WHI is the watershed health index score. Risk 1 indicates watershed impairment; however, the Forest Service may influence conditions to improve the watershed. Risk 2 also indicates watershed impairment; however, Forest Service opportunity to measurably affect the watershed is limited. Sources of risk: S = sediment; P = point-source pollution; T = temperature; F = altered flow.

Watershed	Ownership	WCR	Watershed Condition			WCR						
HUC	%	Current	Low Risk	Risk 1	Risk 2	Alt-A	Alt-B	Alt-D	Alt-E	Alt-F	Alt-G	Alt-I
305010601	26.255	A			S	A	A	A	A	A	A	A
305010602	0.535	A			S	A	A	A	A	A	A	A
305010603	0.746	BA			S	BA	BA	BA	BA	BA	BA	BA
305010604	1.083	A			S	A	A	A	A	A	A	A
305010605	7.326	A			S	A	A	A	A	A	A	A
305010607	0.003	A			S	A	A	A	A	A	A	A
305010705	16.627	A			S	A	A	A	A	A	A	A
305010706	3.181	BA			SP	BA	BA	BA	BA	BA	BA	BA
305010707	31.367	A			S	A	A	A	A	A	A	A
305010802	23.185	A			S	A	A	A	A	A	A	A
305010804	23.521	A			S	A	A	A	A	A	A	A
305010805	48.860	A	-		S	A	A	A	A	A	A	A
305010806	44.153	E	X			A	A	A	A	A	A	A
305010915	0.068	A			S	A	A	A	A	A	A	A
306010102	9.505	E	X			A	A	A	A	A	A	A
306010103	0.716	E	X			E	E	E	E	E	E	E
306010105	15.747	A			S	A	A	A	A	A	A	A
306010108	3.351	BA			S	BA	BA	BA	BA	BA	BA	BA
306010201	13.689	BA		S		BA	BA	BA	BA	BA	BA	BA
306010208	10.315	A			S	A	A	A	A	A	A	A
306010212	41.725	A		S		A	A	A	A	A	A	A
306010310	3.718	A			S	A	A	A	A	A	A	A
306010314	5.932	A			S	A	A	A	A	A	A	A
306010315	26.735	A		S		A	A	A	A	A	A	A
306010603	30.477	E	X			E	E	E	E	E	E	E
306010701	8.633	A		S		A	A	A	A	A	A	A
306010702	15.318	A		S		A	A	A	A	A	A	A
306010704	13.400	A		S		A	A	A	A	A	A	A

Threatened, Endangered, and Sensitive Species

Affected Environment

The Sumter National Forest provides habitat for eight federally threatened and endangered species and 30 Forest Service sensitive species, including one candidate for federal listing (see Appendix E for complete listing). Sensitive species are designated by the Regional Forester and include species occurring on the forest with rangewide viability concerns, but which are not included on lists of endangered, threatened, proposed, or candidate species. Sensitive species receive special management emphasis in order to ensure their viability and to preclude trends toward federal listing or endangerment. Of the species groups represented on the forest's threatened, endangered, and sensitive species (PETS) list, there are five birds, three mussels, one salamander, one crayfish, one fish, one butterfly, two bats, and twenty-six plants.

Effects of alternatives on threatened, endangered, sensitive species (PETS), and locally rare species were included in the viability analysis associated with the forest plan (see section on Species Viability). Effects of forest plan implementation on threatened, endangered, and sensitive species are more thoroughly discussed in the biological assessment (BA; see Appendix F). A review of affected environment and significant direct, indirect, and cumulative effects for threatened, endangered, and candidate species, including species on county lists obtained from the U.S. Fish and Wildlife Service (for counties containing national forest land), but which are not likely to occur on the forest, are also addressed below.

Pool Sprite (Amphianthus pusillus)

Pool sprite is a small, federally threatened aquatic winter annual plant restricted to eroded depressions or (rarely) quarry pools formed on flat-to-doming granitic outcrops in Alabama, South Carolina, and Georgia (Recovery Plan for Three Granite Outcrop Plants, p.5). The species appears to be intolerant of competition, inhabiting microsites which are nutrient poor with very shallow soils. Pool sprite is known to occur near monocultures at extensive grantic outcrops located within 50 miles of the national forest, including Heggie's Rock Preserve (owned by the Nature Conservancy) in Georgia and Forty Acre Rock Heritage Preserve in South Carolina. The species, where it occurs, typically flowers in February and March and continues to flower until the microhabitat is desiccated by spring droughts (sometime from March to May), killing the plants (Recovery Plan for Three Granite Outcrop Plants, p.7). Seeds remain dormant either on or within the soils through summer and germination begins in late autumn and peaks in winter. The species is not known from the Sumter National Forest and is not likely to occur there due to the lack of known extensive granitic outcrops occurring on the forest and therefore, lack of suitable habitat. Small granitic outcrops are known from the forest, but no pool sprite is known from these sites and habitat is of low quality.

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle ranges over most of the North American continent, from as far north as Alaska and Canada, down to Mexico. Experts believe that in 1782 when the bald eagle was adopted as our national bird, their numbers may have ranged from 25,000 to 75,000 nesting pairs in the lower 48 states. Since that time the species has suffered from habitat destruction and degradation, illegal shooting, and most notably from contamination of its food source by the pesticide DDT. In the early 1960s, only 417 nesting pairs were found in the lower 48 states. In 1999, more than 5,748 nesting pairs of bald eagles were recorded for the same area, resulting primarily from the banning of DDT in the United States in 1972 aided by additional protection afforded under the Endangered Species Act (USDI, Fish & Wildlife Service, 1999).

Bald eagles have few natural enemies but usually prefer an environment of quiet isolation from areas of human activity (i.e., boat traffic, pedestrians, or buildings), especially for nesting. Their breeding areas are generally close to (within 4 km) coastal areas, bays, rivers, lakes, or other bodies of water that reflect general availability of primary food sources including fish, waterfowl, rodents, reptiles, amphibians, seabirds, and carrion (Andrew and Mosher 1982; Green 1985; Campbell et.al. 1990). Although nesting territory size is variable, it typically may encompass about 2.59 square kilometers (Abbott 1978). Most nest sites are found in the midst of large wooded areas adjacent to marshes, on farmland, or in logged-over areas where scattered seed trees remain (Andrew and Mosher 1982). Two bald eagle nests are known from the Sumter National Forest: one nest near the Savannah River on the Long Cane District, and one on the Broad River on the Enoree District.

*Carolina Heelsplitter (***Lasmigona decorata***) Lea*

The Carolina heelsplitter was federally listed as endangered on June 30, 1977 (U.S. Fish and Wildlife Service 1996). The species was historically known from several locations within the Catawba and Pee Dee River systems in North Carolina, and the Pee Dee and Savannah River systems and possibly the Saluda River system in South Carolina (U.S. Federal Register 2002). More recent inventories indicate the species has been eliminated from the majority of its historic range, and that only six populations are known to exist (U.S. Federal Register 2002). Two of these populations occur on the Long Cane Ranger District of the Sumter National Forest (U.S. Federal Register 2002; U.S. Fish and Wildlife Service 1996).

Critical habitat, designated in July 2002, includes stream reaches within the two units on the Long Cane District of the Sumter National Forest, which contain the Turkey Creek/Mountain Creek/Beaverdam Creek population, and the Cuffytown Creek population (U.S. Federal Register 2002). These reaches correspond to streams occurring within the Turkey Creek watershed and the Upper Stevens Creek watershed, respectively. The greatest threats to the Carolina heelsplitter include pollutants in wastewater discharges, habitat loss and alteration associated with impoundments, channelization, and

dredging operations, channel and streambank scouring associated with increased storm-water runoff, and the runoff of silt, fertilizers, pesticides, and other pollutants from various land disturbance activities with inadequate-to-poorly maintained erosion and stormwater control (U.S. Federal Register 2002; Alderman 1998). Based on various riparian zone functions compiled from as many as 1500 sources of literature, maintenance of a significant wooded riparian corridor is critically important to the survival of the Carolina heelsplitter (Alderman 2002).

Smooth Coneflower (Echinacea laevigata)

Smooth coneflower, a federally endangered species, is a plant of roadsides, open woods, barrens and glades, utility rights-of-way, or other sunny situations, usually in association with calcium- or magnesium-rich soils underlain by mafic rock (Gaddy 1991) Smooth coneflower is known to occur in Georgia, South Carolina, North Carolina, and Virginia, but has been reported historically from Pennsylvania, Maryland, Alabama, and Arkansas as well. Based on information summarized in the recovery plan (April 1995) of 24 surviving populations, seven populations occur on national forest land (South Carolina, Georgia, Virginia), nine occur on private land, and the remaining eight occur under various federal or state ownerships (U.S. Fish and Wildlife Service 1995). The recovery objective for classification from endangered to threatened is 12 geographically distinct, self-sustaining (stable or increasing for 10 years or more) populations.

On the Andrew Pickens Ranger District of the Sumter National Forest, smooth coneflower occurs at eight geographically distinct locations, based on the most recent data. Historically, much of the species' habitat was xeric woodlands, savannas, or grasslands that were maintained in an open condition by fires caused by lightning or Native American burning (Davis et.al. 2002). On the Sumter National Forest, all sites for smooth coneflower occur along roadsides, at least in part. Habitat management, including canopy opening and prescribed burning, on at least three of the sites for several years has resulted in stable populations.

***Florida Gooseberry (*Ribes echinellum)**

Florida gooseberry was designated a federally threatened plant species in August 1985. Florida gooseberry was known from only one population in Florida for several years (FDR 29338, July 1985). A second population was located in McCormick County, South Carolina, in 1957, a site which eventually received protection as a South Carolina Heritage Preserve. Disjunct sub-populations were located in proximity to the second site in McCormick County, including six subcolonies which were found on the Sumter National Forest, Long Cane Ranger District, in 1987. The Long Cane sub-population is located on mesic hardwood forests adjacent to Stevens Creek, and consists of six sub-colonies (Forest Monitoring Data, 1998).

Habitat for the species in South Carolina is deciduous, basic mixed hardwood forests, dominated primarily by oaks and hickories (TNC 1987), with sweetgum, hophornbeam, and species indicative of calcium-rich soils such as Florida sugar maple and basswood. The soil pH at the South Carolina site is 6.7 to 7.4 (TNC 1987). The plant appears to be threatened most by habitat alteration associated with development, logging, or severe fire (USFWS 1978). Competition with invasive non-native plants, such as Japanese honeysuckle, have threatened the South Carolina site (TNC 1987; Forest Monitoring Data 1998).

Georgia Aster (Aster georgianus)

Georgia aster, a candidate for federal listing, is a plant of roadsides, open woods, cedar barrens, utility rights-of-way, or other sunny situations, and appears to be adaptable to dry open habitats independent of soil type. Georgia aster is known to occur in North Carolina, Georgia, South Carolina, and Virginia. Based on data from 2001, Georgia aster occurs at 12 geographically distinct sites on the Sumter National Forest, including 10 on the Enoree and two on the Long Cane, some consisting of more than one subpopulation. All sites occur along roadsides, and population ownership is typically shared with the state highway department or respective utility company. Most of the populations occurring on the Sumter National Forest are declining or at low numbers, with the exception of two. This is likely due to competition with successional vegetation or drought. Historically, much of the species' habitat was xeric woodlands, savannas, or grasslands that were maintained open by fires caused by lightning or Native American burning (Murdock 1995; Davis et.al. 2002).

Persistent Trillium (**Trillium persistens*****)***

The persistent trillium was listed as federally endangered in 1978. Known populations are restricted to the Tallulah-Tugaloo River system in Rabun, Habersham, and Stephens Counties, Georgia, and Oconee County, South Carolina. The trillium appears to be restricted to gorges and steep ravines (USFWS 1984). Habitat is variable, with plants occurring primarily in mixed pine-hemlock forests where they are often associated with *Rhododendron maximum*, or in mixed oak-beech forests (Patrick et.al. 1995). The persistent trillium population in South Carolina is located on private land (USFWS 1984). No populations are known from the Sumter National Forest, but potential habitat does occur there. Threats to the species include recreation use in the form of trails and camping (T. Patrick, pers. commun, USFWS 1984), collection pressure, wildfire, and residential development (USFWS 1984). The species cannot withstand disturbance, and populations on state land near previous trails appear to be flourishing now that the trails have been closed (T. Patrick, pers. commun).

Piedmont Bishop Weed (**Ptilimnium nodosum)**

Piedmont bishopweed, or harperella, was designated a federally endangered plant species in September 1988. Based on information in the recovery plan (1991), the species consists of 13 known populations in seven southeastern states. Four of seven historically known populations were confirmed in 1989 (Recovery Plan, p.15), from Aiken, Barnwell, and Saluda Counties. No populations are known from national forest land. In Maryland, West Virginia, North Carolina, Alabama, and Arkansas, the species occurs in seasonally flooded rock streams (Recovery Plan, p.1). All seven of the South Carolina populations occur in coastal plain ponds (Carolina bays). This habitat type is not likely to occur on the Sumter National Forest. Based on the species' distribution, a small chance of encountering habitat might occur on the Long Cane Ranger District.

Red-cockaded woodpecker (*Picoides borealis*)

The red-cockaded woodpecker (*Picoides borealis*) is a federally listed endangered species endemic to open, mature and old-growth pine ecosystems in the southeastern United States. Currently, there are an estimated 12,500 red-cockaded woodpeckers living in roughly 5,000 family groups across twelve states. This is less than 3% of estimated abundance at the time of European settlement (USFWS 2000). The red-cockaded woodpecker was listed as endangered in 1970 (35 Federal Register 16047) and received federal protection under the Endangered Species Act of 1973. The precipitous decline in population size that led to the species' listing was caused by an almost complete loss of habitat. Fire-maintained old-growth pine savannas and woodlands that once dominated the southeast no longer exist except in a few isolated small patches.

In 1986, seven populations of red-cockaded woodpeckers existed on national forest lands in SAA forests (Costa and Escano 1989). Red-cockaded woodpecker populations were on the Bankhead NF, Cherokee NF, Conecuh NF, Daniel Boone NF, Oakmulgee Division (of Talladega NF), Oconee-Hitchiti NF, and Talladega Division (of Talladega NF). Red-cockaded woodpeckers once inhabited the Sumter National Forest, but have not been observed there for over 20 years (personal observations, Forest Service personnel) and are now considered extirpated from the forest. The Sumter National Forest is not included in recovery plans or strategies, including the *FEIS for the Management of the Red-cockaded Woodpecker in the Southern Region* (USDA-FS 1995), nor the USDI Draft Revised Recovery Plan (U.S. Fish and Wildlife Service 2000).

Relict trillium (Trillium reliquum)

Relict trillium is a federally endangered species of basic mesic hardwood forests occurring on soils that contain a high level of organic matter and medium to high levels of calcium. The largest and most vigorous populations are located in the lower piedmont/fall line sandhills province, in drainages of both the Savannah and Chattahoochee Rivers of Georgia and South Carolina. Relict trillium is known to occur from 21 populations (U.S. Fish and Wildlife Service 1990) in Alabama, Georgia, and South Carolina, but none of the populations occur on national forest land. Primary threats to the species are loss of habitat resulting from urban development, and in some

cases, competition with invasive non-native species, logging, species conversion, or fire (TNC 1990). Although no populations are known from national forest land in Alabama, South Carolina, or Georgia, habitat is known to exist there.

*Small whorled pogonia (***Isotria medeoloides***)*

The small whorled pogonia was listed by the U. S. Fish and Wildlife Service (USFWS) as endangered in 1982 and revised to threatened status in 1992 based on discovery of new sites, achievement of protection for many of the sites, and additional life history and population information (U.S. Fish and Wildlife Service 1992) written for the species. Small whorled pogonia is known from 16 states, including Virginia, West Virginia, North and South Carolina, Georgia, and Tennessee (NatureServe 2001). The Sumter National Forest has four existing sites for small whorled pogonia, though eight were known historically (Gaddy 1985). Numbers of individuals at each site range from 1 to 45 according to forest monitoring data dating back to 1985. Colony sizes and stem counts of the species fluctuate widely year-to-year, a fact that makes viability assessment difficult and which is also noted in the 1992 Recovery Plan.

This species is found primarily in second and third-growth deciduous and mixed-deciduous/coniferous forests. Ages of the older trees on the sites vary from as young as 30-years-old in South Carolina to 80-years-old in Virginia. The forest habitat in which this orchid is found is not rare, yet only a small percentage of the habitat has colonies of small whorled pogonia. Site characteristics are highly variable, but are usually mesic, with sparse to moderate ground cover and a relatively open understory canopy. Old logging roads or streams are often nearby. Many sites show signs of past agricultural use (USFWS 1992, pers.obs).

Wood Stork (Mycteria americana)

The United States breeding population of wood storks is listed as an endangered species. This species may have formerly bred in all the coastal southeastern United States from Texas to South Carolina. Currently, they breed throughout Florida, Georgia, and coastal South Carolina. Post-breeding storks from Florida, Georgia, and South Carolina occasionally disperse as far north as North Carolina and as far west as Mississippi and Alabama. The estimated total population of nesting storks throughout the southeastern United States declined from 15,000 to 20,000 pairs during the 1930s to a low of between 4,500 and 5,700 pairs for most years between 1977 and 1980. Since 1983, the U.S. population has ranged between 5,500 and 6,500 pairs. Factors contributing to the decline include loss of feeding habitat, water level manipulations affecting drainage, predation and/or lack of nest tree regeneration, and human disturbance (U. S. Fish and Wildlife Service 1996).

Portions of the piedmont on the Sumter National Forest are used as late summer foraging areas by post-breeding storks that disperse from the nesting areas (Gary Peters and

Donna Ray, personal comment). There are no known nesting or roost sites on the Sumter National Forest. The closest nesting colony is in Georgia just south of the Savannah River Site, at least 100 miles to the southeast. On the Sumter, wood storks forage in small wetlands, including beaver ponds and small streams. Use of most feeding areas is short-term and the use of any individual area varies from year-to-year depending on water-levels and the availability of forage fish. The use of these sites as foraging areas is dependent on the availability of appropriate water levels during late summer, which to a great degree is dictated by weather conditions.

Direct, and Indirect Effects

All alternatives include the general goal of contributing towards the recovery of federally-listed threatened and endangered species (T&E). Additionally, the following activities are common across all alternatives, with the exception of Alternative F (current management):

- Recovery plans (when available) will be followed for all T&E species.
- Forestwide habitat or population objectives for all threatened, endangered, candidate, and other species with viability concerns on the forest will be followed to recover the species or prevent federal listing.
- Several forestwide and management area standards and allocations will conserve species and or associated habitat.
- Threatened, endangered, and sensitive species will be addressed and conserved through the site-specific biological evaluation process.

Direct effects to threatened, endangered, or sensitive species are unlikely across all alternatives, and would not likely jeopardize the continued existence of threatened and endangered species, or effect viability for sensitive species.

Several management prescriptions facilitate the conservation of habitat for threatened, endangered, and sensitive species habitat across all alternatives with the exception of Alternative F, current management. The riparian prescription (MP 11), with its emphasis on low levels of disturbance and maintenance of aquatic and riparian values, conserves habitat for the aquatic PETS such as mussels, crayfish, and fish, and several rare plants. The rare community prescription (9F) and associated goals and forestwide or prescription-level standards, will provide optimal habitat conditions for the majority of PETS species. This prescription will also be applied across all alternatives with the exception of Alternative F. Habitat for the Carolina heelsplitter will receive additional consideration through the designation of the Turkey Creek and Upper Stevens Creek Management Area in Alternative I.

Several PETS species, including smooth coneflower and Georgia aster, require active management to create open, grass-dominated woodlands preferred by the species.
All alternatives strive to create conditions required by woodland-associated species.

Other restoration-oriented objectives, such as restoration of shortleaf pine and conditions for oaks on the piedmont, will provide additional habitat benefits for species associated with them.

As a result of implementing all alternatives with the exception of Alternative F (current management), there are likely to be beneficial indirect effects to habitats for all PETS, though the magnitude of the habitat benefits will vary somewhat across alternatives. Benefits are likely to be greatest under Alternative B, which emphasizes biological restoration; Alternative G, which emphasizes T&E habitat and watershed restoration; and Alternative I, based on the management area allocation for watersheds containing the federally endangered Carolina heelsplitter. Benefits to PETS would be less under Alternatives A, D, and E, and least under Alternative F, current management.

Cumulative Effects

The Sumter National Forest has an ownership pattern that is highly fragmented by private land. Based on a broad scale watershed assessment for the forest (Hansen 2002), only three 5th order watersheds, of the twenty-seven 5th order watersheds identified, contain over one-third of their area in national forest. This fragmented ownership pattern can limit landscape level efforts required for some PETS species, especially wide-ranging species, those associated with aquatic habitats, or those requiring landscape-level restoration processes such as the use of prescribed fire.

Public land plays a critical role in the conservation of federally listed plants, which receive no protection on private land, and all T&E habitats, which receive no protection on private lands, and sensitive species, which receive no protection on private land. During the next 10 to 50 years of forest plan implementation, human populations are likely to expand, affecting urbanization, roads and associated traffic, and the use of the national forests by humans. This suggests the public land will play an increasingly important role in the conservation of threatened, endangered, and sensitive species in the future, but that management to ensure recovery and/or prevent federal listing of species will be an increasingly difficult challenge.

All forest plan alternatives contain goals and forestwide standards, and are subject to laws, regulations, and Forest Service policy requiring the conservation of threatened, endangered, and sensitive species. This suggests that the cumulative effects of implementing all alternatives will be beneficial.

Demand Species

Northern Bobwhite

Affected Environment

Northern bobwhite numbers have declined steadily throughout their range for over 40 years and quite likely, for much longer. From 1980 to 1999, fall bobwhite populations declined 65.8% and projected trends indicate a further decline of approximately 53.9% over the next two decades (Dimmick et.al. 2002).

A lack of nesting and brood-rearing cover is considered the major limiting factor over much of the range of the northern bobwhite. The loss of native warm season plant communities by planting non-native grasses, planting dense pine forests, and intensive production of row crops is principally responsible for limiting bobwhite populations as well as other species such as loggerhead shrike, dickcissel, bobolink, Henslow's sparrow, Bachman's sparrow, and field sparrow. Managed warm season grasses with an adequate component of forbs provide good to excellent nesting and brood-rearing habitat. Southern pines can be managed to encourage development of habitat conditions favorable for northern bobwhite. Hardwood forests provide important winter habitats for bobwhite throughout much of its range. Hardwood savanna management provides habitat conditions that promote bobwhite productivity and survival.

Northern bobwhites have specific seasonal needs that vary throughout the year. This species favors abandoned fields and brushy areas such as wood margins, hedgerows, thickets, and open woods (Hamel 1992). Summer nesting cover and summer brood habitat consisting of grassy areas (preferably bunch grasses) and weedy patches with exposed bare ground are needed to provide for the recruitment within a population. Winter food and winter cover of seed producing plants and shrubby thickets are needed to carry populations through the dormant season (Rosene 1985). Habitat conditions for bobwhite quail require disturbances from burning and mowing or discing on 2 to 3 year intervals.

Good northern bobwhite habitat requires good interspersion of food species and cover that is not too dense. Good habitat can support about one bird per acre (2.5/ha; Murray 1957). In a habitat improvement experiment in Florida, pine forests were cleared and subterranean clover (*Trifolium subterraneum*) planted to encourage the establishment of arthropods, an important food for chicks (Ribbeck 1987). Areas that were sharecropped and burned during winter and spring at 2-year intervals produced more quail than areas planted with food patches or areas that were sharecropped but not burned (Ellis 1969).

Rosene (1969) recommended managing forests on an uneven-aged rotation basis, and thinning after 20 years to maintain an open canopy. He also suggested creating park-like woodlands in the South with high open canopies and a thin, spotty pattern of shrubs in the understory.

Predators of adult northern bobwhite include hawks and eagles (*Accipitridae*), falcons (*Falconidae*), foxes (*Vulpes*, *Urocyon*), bobcat (*Lynx rufus*), and domestic cats (*Felis sylvestris*) and dogs (*Canis domesticus*). Predators of chicks and eggs include weasels and skunks (*Mustelidae*), raccoons (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), snakes (*Coluber spp.; Elaphe spp*.), crows and ravens (*Corvus spp*.), rats (*Ratus norvegicus*), squirrels and chipmunks (*Sciuridae*) (Klimstra 1975; Murray 1957; Terres 1980). The bobwhite quail is also a popular game bird throughout much of its range with days spent afield by hunters also in decline in recent years.

The recovery of bobwhite quail may be difficult with an accelerating loss of available land to create and maintain quail habitat throughout its range. Restoring bobwhite populations range-wide will depend upon: the amount of agricultural lands that are enhanced to provide nesting, brood rearing, and roosting habitats for quail and other grassland species; the amount of pine dominated and mixed pine hardwood lands that are managed to provide open grass- and forb-dominated ground cover through thinning, harvesting, and periodic burning; and the amount of rangeland that is managed to improve native plant communities and provide quail food and cover.

Since 1966, populations of northern bobwhite in South Carolina appear to have been steadily decreasing (trend estimate –4.42; p=0.0000; Sauer et.al. 2000). Breeding bird surveys on the forest have shown a downward trend that can also be attributed to a lack of early successional habitat and isolated habitat fragments. Several avian species within the same guild as the northern bobwhite quail are also declining. These species include Bachman's sparrow, prairie warbler, loggerhead shrike, whip-poor-will's and other associated resident and neotropical migratory songbirds.

Recent covey counts and covey estimates have been calculated on SCDNR WMA tracts (SCDNR 2001 data) in South Carolina. These tracts have been intensively managed for bobwhite quail and associated species. The data show increased density in birds per acre for those lands that are managed through prescribed burning and other habitat manipulation. Pre-treatment data for a 4,000 acre tract on the Long Cane Ranger District shows that a hunter can expect to find only one covey per 109 acres or 0.01 birds per acre.

Direct and Indirect Effects

Habitat needs for northern bobwhite were considered during development of habitat management provisions included in the draft revised forest plan by reviewing and incorporating elements of the *Northern Bobwhite Conservation Initiative* (Dimmick et.al. 2002), a report by the Southeast Quail Study Group Technical Committee. Habitat provisions that are expected to lead to improved conditions for quail include those for restoration of woodlands, savannas, and grasslands, restoration and maintenance of open pine forests, creation of early successional forests, and maintenance of permanent openings. Differing effects of alternatives on quail habitat are indicated under sections

on Woodlands, Savannas, and Grasslands; Pine and Pine-Oak Forests; Mix of Early and Late Successional Forests; and Permanent Openings. In general, alternatives that provide for higher levels of prescribed fire and vegetation management would favor quail habitat and populations. Alternatives with an emphasis on permanent openings (F, E), restoring woodland/savanna conditions ((B, D, E, I), and providing early successional forest conditions (A, D, F, and I) would have the greatest benefit for this species.

The alternatives that include management activities that would create early successional habitat can be expected to favor populations of quail and associated species. Recent studies by the South Carolina Department of Natural Resources on WMA tracts have shown that populations of quail increase with habitat manipulation such as thinning and prescribed burning on a regular basis. Since the lack of suitable habitat (e.g., early successional forest) is believed to be the limiting variable of bobwhite quail, an aggressive attempt to reclaim and maintain suitable habitats on the national forests will result with a continual increase in their population.

Cumulative Effects

Cumulatively, trends in habitat quality and quantity on nearby private lands are likely to continue. With few exceptions, it is not expected that private landowners will restore or manage to maintain significant amounts of high quality quail habitat. The decline of early successional forest and uneven aged stands on public lands and the increase or the accumulating of mature forest landscapes have forced the decline of bobwhite quail. The lack of a structured or strategic timber harvest regime that perpetuates a mosaic of habitats has been detrimental to quail and many other species of wildlife. Among the alternatives considered, Alternative G would provide the least amount of habitat and Alternatives E and F would provide the greatest amounts of habitat for quail.

American Woodcock

Affected Environment

Although classed as a game bird, populations of woodcock have shown large declines in the eastern U.S. since surveys began in 1968 (Krementz and Jackson 1999). In the Southern Appalachians and Piedmont, breeding populations are highly variable in density and spotty in distribution. Wintering population densities vary from year-to-year, but the species is much more common and widely distributed in winter than in summer in the South. According to conservation status rankings, the woodcock is apparently secure in Alabama and Tennessee, and is secure in Virginia and Georgia; its status is unranked in South Carolina (Natureserve 2001). The woodcock is listed as a priority species under the Forest Service's southern national forest migratory and resident landbird conservation strategy (Gaines and Morris 1996).

The American woodcock is closely associated with young second-growth hardwoods and other early-successional habitats that are a result of periodic forest disturbance (Straw

et.al. 1994). Ideal habitat consists of young forests and abandoned farmland mixed with forested land (Keppie and Whiting 1994). These include forest openings or clearings for singing displays in spring, shrubby thickets or other young hardwoods on moist soils for feeding and daytime cover, young second-growth hardwoods for nesting, and large fields for night-time roosts (Mendall and Aldous 1943; Andrle and Carroll 1988; Boothe and Parker 2000). European settlement and subsequent clearing presumably favored this species (Foss 1994).

To support woodcock populations, habitat structure appropriate for feeding, display/roosting, and nesting all must be provided in suitable areas and in adequate configurations. Feeding habitat is much less open than display/roosting habitat and consists predominantly of second-growth (15- to 30-years-old) hardwood or mixed woods with shrubs, but also includes bottomland hardwoods with canopy gaps, upland mixed pine-hardwoods with a herbaceous/grassy understory, and mature longleaf pine after recent burning (Keppie and Whiting 1994). Dense thickets less than 20 years of age are especially important throughout much of the woodcock's range. Typical overstory canopy cover in daytime sites during breeding season is 53-64% (Dunford and Owen 1973). Shrub cover is also typically high (75-87%; Morgenweck 1977) and often adjacent to more open display habitat. Moist, generally loamy soils are important for foraging, because they provide abundant and available earthworms, which is the woodcock's primary food.

Roosting and display habitat is typically open fields or regenerating forests. Maintenance of old fields for roosting and display habitat can be accomplished through disking, mowing, use of herbicides, and prescribed burns, although maintaining some small trees and shrubs is desirable. The goal is to create open habitats that are "patchy," rather than uniform in structure. As the ground and mid-story vegetation disappear through succession, woodcock will cease using the site (Krementz and Jackson 1999).

Silvicultural practices can also enhance habitat (Sepik et.al. 1981; Rosenberg and Hodgman 2000). Clearcuts can provide good nocturnal roosting habitat. Furthermore, clearcutting small strips and blocks in mature woods in Maine has been shown to increase numbers (Dwyer et.al. 1982a); new blocks or strips are cut every 8-10 years on a 40-50-year rotation to provide a continuous supply of young growth. McAuley et.al. (1996) recommend maintaining at least 25% of land in early-successional habitat by clearcutting blocks at least 2 ha, or 30 m-wide strips, in mature forest on a 40-year rotation. Stands dominated by shrub species may be encouraged and maintained by strip-cutting on a 20-year rotation for woodcock (Sepik et.al. 1981). Shelterwood and seed trees left in partial timber harvests help to retain the patchy structure that woodcock prefer. Thinning and selection harvests can also improve dense forests for woodcock by allowing light to reach the ground. Boothe and Parker (2000) recommend burning slash from clearcuts to enhance these openings for woodcock nesting, courting, and roosting. Shifts away from even-aged forest management may be detrimental to populations (Keppie and Whiting 1994; Rosenberg and Hodgman 2000).

Natural disturbances historically responsible for creation of early-successional habitat also improve woodcock habitat. Beavers created extensive habitat, as did fire and possibly windstorms. In general, maintaining integrity of wetter sites such as springs, streams, and creeks is beneficial to these species. Allowing thickets to grow in riparian areas will greatly improve habitat quality for woodcock, (Krementz and Jackson 1999). Grassy areas near water provide prime nesting and display grounds.

Non-breeding or wintering habitat is similar to breeding habitat but typically includes more open conditions such as sedge meadows, beaver pond margins, rice fields, upper reaches of estuaries and occasionally coastal meadows (del Hoyo et.al. 1996). Winter habitats range from bottomland hardwoods to upland pine forests, young pine plantations, and mature pine-hardwood forests, though in some pine habitats the birds tend to focus their activities in lowlands dominated by hardwoods (Roberts 1993). Unlike during breeding, mature pine-hardwood and bottomland hardwoods are often preferred (Krementz and Pendleton 1994; Horton and Causey 1979). During the non-breeding season, woodcock generally occupy moist thickets in daytime, and shift to more open habitats such as pastures, fields (including agricultural), and young clearcuts at night. A diversity of habitat types and age classes may be especially important to survival when severe weather forces woodcock from preferred sites (Krementz and Pendleton 1994). The use of prescribed burns is a common forest management practice and can be used to set back plant succession. A light, controlled fire can maintain habitat patchiness as well. Burns may also remove pine needle cover, opening the ground to woodcock foraging. Mowing can also be used to improve foraging habitat, but appropriate habitat should be maintained for nesting birds (Roberts 1993).

Breeding populations of woodcock are low and poorly distributed in the piedmont and more common in the mountains of South Carolina. Although populations of woodcock fluctuate, both physiographic areas on the Sumter support large numbers of woodcock during migration and over the winter months in suitable habitats. High quality woodcock breeding, stop-over, and wintering habitat is currently limited in supply and distribution on the forest.

Direct and Indirect Effects

Habitat needs for American woodcock were considered during development of habitat management provisions included in the draft revised forest plan. Habitat provisions that are expected to lead to improved conditions for woodcock include those for maintenance of some level of early-successional riparian habitat, creation of early-successional forests in general, and establishment and maintenance of permanent openings. Differing effects of alternatives on woodcock habitat are indicated under sections on Riparian Areas, Successional Forests, and Permanent Openings. In general, alternatives that provide for higher levels of early successional forests (Alternatives A, D, F, I), early succession in riparian areas (B, E, F, I), and those that have an emphasis on permanent openings (E, F) and woodland/savanna habitats (B, I) would favor woodcock habitat and populations.

Cumulative Effects

Extensive harvesting activities on private forestlands in the piedmont provide suitable stopover and wintering habitats, but limited nesting habitat for woodcock. Little activity affecting the abundance or distribution of suitable habitat for woodcock.occurs in the mountains.

Black Bear

Affected Environment

The black bear (Ursus americanus) uses a wide variety of habitats in the Southern Appalachians, occurring primarily on national forests, national parks and large state managed properties of the Southern Blue Ridge, Northern Cumberland, and Allegheny Mountains and the Northern Ridge and Valley. These public lands in Virginia, West Virginia, North Carolina, South Carolina, Tennessee, and Georgia connect to form a forested landscape of over 6 million acres where bears are generally distributed at low to medium densities. The diversity of habitats including older oak forests in this large block of habitat, along with increased protection and conservative hunter harvest, has allowed bear populations throughout the southeastern mountain region to increase six-fold over the past 30 years (Pelton 2001). Average annual bear harvest in South Carolina has increased 10-fold over the same time period (SCDNR data).

South Carolina’s mountain black bear population is found in the extreme northwestern counties of the state, which includes the Andrew Pickens Ranger District of the Sumter National Forest. The trend in bear harvest combined with the increase in nuisance bear reports and information from annual bait station surveys over the last ten years indicate the black bear population is increasing in and around the Andrew Pickens Ranger District (SCDNR data). Although there is increased interest in black bears in the piedmont, bears are generally absent to transient in this physiographic area (SAMAB 1995:61, SCDNR).

At one time it was generally accepted that levels of human access within bear habitat determine the degree of negative effects on bears (Beringer 1986; Brody and Pelton 1989), and high bear population densities were associated with areas of low open road density (SAMAB 1995:87). While open roads are still an influence on bear populations, evidence suggests that, in recent years high bear densities and the greatest increases in populations are occurring in landscapes where people live, particularly where some agricultural land uses are present.

The Andrew Pickens Ranger District represents about one-fourth of available bear habitat in the mountains of South Carolina. On the Sumter National Forest, important habitat elements are areas with limited open road access, availability of escape cover, habitat diversity, and availability of hard and soft mast. Black bears are opportunistic omnivores and consume a variety of seasonal plant and animal foods including flowering plants,

grasses, various roots and tubers, and especially soft mast (grapes, berries, apples, etc.). The availability of soft mast (fruit and berries) in the spring and summer is the determining factor in bear movements, body weights, and nuisance bear reports prior to mast crops in the fall. Availability of hard mast (acorns and hickory nuts) is critical throughout the winter, and reproductive success is closely related to this habitat factor (Eiler 1981; Wathen 1983; Eiler et.al. 1989). Total production of hard mast and production by individual trees can fluctuate from year-to-year due to climatic and other factors (Downs and McQuilkin 1944; Fowells 1965). Results of South Carolina's annual hard mast survey are displayed in Figure 3-9.

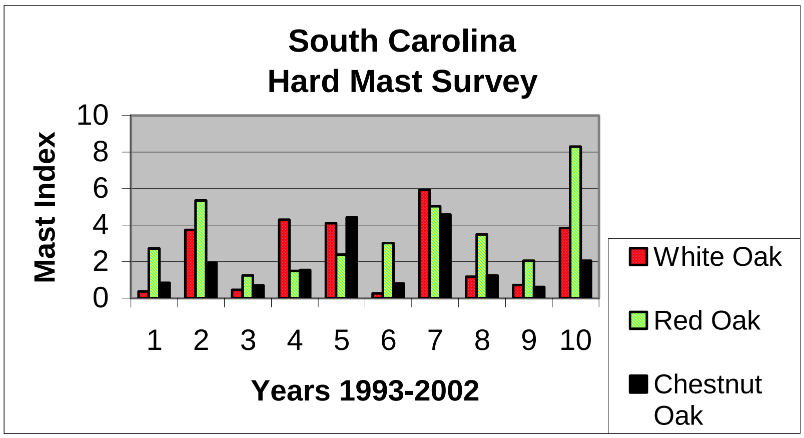


Figure 3-9. Summary of South Carolina's annual hard mast survey.

Under general Southern Appalachian forest conditions, most oaks produce acorns from 40 years of age until death (150 to 200-plus years), although production drops off in later years (USDA Forest Service 1990). Average annual white oak acorn production begins to decline when trees reach about 30 inches dbh (diameter at breast height) (Greenberg 1999; Johnson 1994), and northern red oak acorn production also declines at about 30 inches (Greenberg 1994). Black and scarlet oaks are prolific producers at smaller size classes. Chestnut oak production peaks at about 20 inches dbh and production remains relatively stable after that (Johnson 1994). Acorn production can be sustained over time by ensuring adequate regeneration of oaks, releasing super-canopy highly productive white oaks and providing a wide variety of species and age classes of oaks across the landscape.

Since bears utilize nearly any abundant plant or animal food, they are likely to thrive when a diversity of forest age classes and food sources are available. Vegetation management can provide much of this diversity (Reagan 1990). Naturally occurring disturbances such as ice storms, wildfires, and hurricanes provide habitat diversity, but at random intervals and locations; benefits may be limited and unreliable.

Bears den in a wide variety of sites including road culverts, abandoned buildings, and in vegetation (Carlock et.al. 1983). Traditional dens are found on the ground in caves,

rockfalls, or under the root mass of uprooted trees, and in hollow trees. Carlock et. al. (1983) and M. Vaughan (pers. comm.) found that hollow trees are preferred dens. Brody (1984) found that ground dens are preferred in the North Carolina mountains. Preference may be related to availability and may be a learned behavior (Brody 1984).

Hunting demand for black bear in South Carolina is also increasing. The number of bear hunting permits sold remained relatively stable from the early 1980s through 1992. Permit sales in recent years have been steadily increasing, nearly doubling the average permit sales between 1981 and 1992 (491 permits), in 2002 (932 permits).

Direct and Indirect Effects

South Carolina Department of Natural Resources regulation of hunter harvest is the primary influence on bear population levels on the Andrew Pickens Ranger District. However, national forest management determines habitat features such as levels of public access, levels of vegetation diversity, availability of hard and soft mast, and availability of den trees.

Alternatives with a majority of the Andrew Pickens Ranger District assigned to management prescription 8.A1 (Alt. I) will provide substantial improvements for establishing and maintaining quality habitat for black bear. The 8.A1 prescription is designed to provide abundant supplies of hard mast, a perpetual supply of escape cover and soft mast in regeneration areas, and an increase in land area with seasonal or year-round restrictions on motor vehicle access. The combination of these management actions is beneficial for bear. Other alternatives (E, F), and 7E2 and 10B prescriptions (Alternatives A, D, & E) will also provide suitable conditions for bear through the development of early-successional forests. Habitat diversity by alternative is further addressed in the section on Mixed Early and Late Successional Forests. Potential for hard mast production is described in part in sections on Mesic Deciduous Forests and Oak and Oak-Pine Forests.

Availability of potential den trees on the Sumter National Forest is augmented by a forestwide standard requiring their retention during all vegetation management treatments. Potential dens are trees greater than 20 inches dbh that are hollow with broken tops (Carlock et.al. 1983). This standard applies across all alternatives. Dens are addressed under Section 4.3, Snags, Dens, and Downed Wood.

Also related to human access are issues of inappropriate food and trash disposal and occurrence of “nuisance bear” activity (Stiver 1988; Rogers 1976). The Sumter National Forest developed a forestwide objective to provide recreation facilities, recreation services, public information, and enforcement to minimize wildlife access to human food and trash where appropriate. This would minimize bear mortality and injury related to “nuisance” behavior.

Black bear populations are expected to persist and increase in population across the Sumter National Forest through implementation of each of the alternatives.

Cumulative Effects

The current status of South Carolina's mountain black bear population is good (SCDNR 2002). The overall regional forecast is for potential bear habitat to remain stable on public land, including the Sumter National Forest and adjacent Jocassee Gorges area. It is not expected that private landowners will restore or manage to maintain significant amounts of high quality black bear habitat, which will tend to further concentrate black bear populations on public lands. Decreases in black bear populations are expected on private lands due to continued loss of forested habitats and increased development (SAMAB 1995:87).

White-tailed Deer

Affected Environment

White-tailed deer use a variety of forest types and successional stages to meet their year-round needs. In the Southern Appalachians, regeneration areas and older forests provide complementary benefits to deer (Johnson et.al. 1995). Older forests generally are most important in the fall and winter when acorns are the dominant fall and winter food item (Wentworth et.al. 1990a). Deer nutrition, reproduction, weights, and antler characteristics are influenced by the availability of acorns (Harlow et.al. 1975; Feldhammer et.al. 1989; Wentworth et.al. 1990a, 1992). Use of even-aged regeneration areas was very low in winter (Wentworth et.al. 1990b). However in the spring and summer, regeneration areas provide an abundance of food and are heavily utilized (Wentworth et.al.1990b; Ford et.al. 1993). Young regenerating stands contain substantial quantities of woody browse, herbs, fungi, and soft mast, all of which are limited in older forests (Johnson et.al. 1995). Food plots, especially those containing clover-grass mixtures, are used most intensively in early spring. They also are an important source of nutritious forage in winter, especially when acorns are in short supply (Wentworth et.al. 1990b).

In eastern hardwood forests, Barber (1984) recommended that at least 50% of the acreage should consist of mature mast trees with the remainder containing an interspersion of evergreens, shrubs and vines, and openings with herbaceous and young-growth woody vegetation. Based on utilization data, current deer densities in the Southern Appalachians can be maintained by providing approximately 5% in regenerating stands (Wentworth et.al. 1990b). Wentworth et.al. (1989) concluded that approximately 2% of the area in high quality wildlife openings would be necessary to adequately buffer the effects of a poor acorn year.

Acorns also are important for deer in the piedmont (Harlow and Hooper 1971). However, because of the availability of alternative high quality foods, especially Japanese honeysuckle and agricultural crops, deer are less mast dependant than in the mountains. Prescribed burning, thinning, and regulated timber harvest all can be used to improve habitat conditions for deer. Whittington (1984) described a management system where pine forests are managed on an 80-year rotation with an 8-year cutting cycle. Each entry, 85% of the area is thinned, 10% is regenerated and 5% is retained in wildlife openings. Approximately 20% is maintained in oak dominated hardwood stands of mast producing age.

White-tailed deer are present throughout the Southern Appalachian Assessment area and the piedmont. Population densities generally are medium to high in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, and Southern Appalachian Piedmont sections (SAMAB 1996: 50-60). High population densities are associated with greater amounts of dispersion of forests and cropland and lesser amounts of coniferous forestland managed on short rotations. Deer densities greatly increased over the last half-century in South Carolina due to extensive restoration efforts. As a result, deer are established in all counties in the state at population levels that support hunting. Current deer densities generally are higher on private land, national forests, and state properties where habitat management is occurring than on other surrounding ownerships.

The white-tailed deer is economically and ecologically the most important wildlife species in the South (Miller 1996). In South Carolina the white-tailed deer is the most popular as well as the most economically important game animal (Ruth 2001). Game harvest regulations and habitat improvement techniques – such as forest thinnings, prescribed burning, and wildlife opening development – have helped create healthy deer populations throughout the state.

Deer population densities in South Carolina are higher in the piedmont than in the mountains. In 1996 the deer population was estimated to be between 15 and 30 deer per square mile in the counties that include the Andrew Pickens Ranger District (Miller 1996). The deer density was estimated to be greater than 30 deer per square mile in the piedmont counties that include the Enoree and Long Cane Districts. Overall the deer populations on the national forest are believed to be increasing because in 2000, the deer populations were estimated in some areas to be from 15 to 45 deer per square mile in the piedmont, and 15 to 30 deer per square mile in Oconee County (includes the Andrew Pickens District) (Ruth 2001). There are three state wildlife management areas (WMAs) that encompass the Sumter NF. During the 2001 deer hunting seasons 308,828 deer were harvested which included the highest statewide doe harvest to date (Ruth). An estimated 42,000 of the 149,993 licensed South Carolina deer hunters possessed WMA permits (Ruth). Ruth further estimated 6,723 of those possessing WMA permits hunted 109,936 days and harvested 13,593 deer. The longest deer season in the Nation combined with liberal bag limits appears to have stabilized the growth of the herd at an annual harvest level of approximately 300,000 animals (Ruth 2001).

The demand for and use of WMAs on the national forests for deer hunting has been increasing in recent years. Total land area in WMAs statewide is declining and the Francis Marion and Sumter National Forests now provide over 60% of the public hunting land in the state. The result is more hunters are spending more days afield in pursuit of deer on national forests in South Carolina. This trend is expected to continue with increased competition for leased hunting rights on private lands in South Carolina.

Direct and Indirect Effects

As discussed above, white-tailed deer require a mixture of forest/successional stage habitats to meet their year-round habitat needs. Key requirements include the interspersion of mature mast-producing stands during the fall and winter, early successional habitats to provide browse and soft mast, and permanent openings. The effects of each of the alternatives on these key habitat features are discussed in detail in previous sections.

Even though South Carolina has been in drought conditions from 1996 to 2002, hard and soft mast production on the Sumter National Forest appears to be relatively consistent (SCDNR data). In the last 10 years there has been a drastic decline in timber harvest on the Sumter National Forest. The decrease in timber harvest has resulted in an accumulation of immature to mature forest stands. Deer will persist and possibly thrive within these forest conditions, but they will move or expand their home ranges when their essential requirements (i.e., food, cover, and water) are not readily available (Garner 2001). Dense stands and closed canopies reduce browse and fruit yields (Yarrow and Yarrow 1999). Deer density maintenance, production, and health could be improved if thinnings or uneven-aged timber harvesting practices (primarily group selection) were implemented. Yarrow recommends a targeted basal area of 50 to 60 square feet per acre to open the overstory and encourage the production of desirable understory vegetation when managing a southern forest for deer. Tactical timber harvesting practices will furnish deer with essential varieties of browse and cover (McCabe and McCabe 1984; Kammermeyer and Thackston 1995; Palik and Engstorm 1999). The result of timber harvesting due to recent southern pine beetle outbreaks has slightly improved diversity of forest stands and provided temporary forest openings needed by many species of wildlife, including deer.

Through proper habitat manipulation with timber management and liberal deer harvest regulations, the Sumter National Forest is able to support existing-to-slightly denser populations of deer. If deer populations are not available to hunters however, or if forests are mismanaged, habitat damage, increases in vehicle accidents, and property damage (e.g., row crops, gardens, ornamental plants) could be expected as deer thrive and move to new sources of food throughout the year.

Cumulative Effects

Deer prefer habitat diversity. Pure stands of unmanaged pine generally provide poor deer habitat because of the low abundance and quality of understory forage and the scarcity of mast-producing hardwoods (Yarrow and Yarrow 1999). Recent management activities on the Sumter National Forest due to southern pine beetle outbreaks have helped create small pockets of suitable and diverse habitats. However, private lands adjacent to the Sumter National Forest likely have more suitable deer habitat and overall better food sources (with the possible exception of hard mast), particularly where agricultural land uses are present. Alternatives with low levels of vegetation management compared to surrounding land uses (B & G) would tend to increase crop damage from deer on adjacent lands. Alternatives A, D, E, F, & I would improve forage conditions on the forest and tend to reduce crop damage on adjacent lands.

Eastern Wild Turkey

Affected Environment

Wild turkey occupy a wide range of habitats, with a diversity of habitats providing optimum conditions (Schroeder 1985). This includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including agricultural clearings for brood-rearing. The variety of habitats used by wild turkeys for roosting, brood-rearing, nesting, feeding, and escape vividly demonstrates the need for a rich mosaic of habitats to provide for wild turkeys alone, much less the many other species of valuable wildlife (Yarrow and Yarrow 1999). Habitat conditions for wild turkey can be enhanced by management activities such as prescribed burning and thinning (Hurst 1978; Pack et.al. 1988), and the development of herbaceous openings (Nenno and Lindzey 1979; Healy and Nenno 1983).

For the eastern hardwood region, Wunz and Pack (1992) recommended maintaining 50 to 75% of the area in mast producing condition and approximately 10% in widely distributed permanent herbaceous openings in addition to the temporary openings that result from timber harvest and other activities. They suggest that regeneration area should be 30 acres in size or less. Light thinnings (<20% of BA) are recommended to enhance the herbaceous component of stands. Heavier thinnings, which may increase the quantity of woody species in the absence of prescribed burning, are less desirable. Prescribed burning in conjunction with thinning in oak forests can be used to enhance brood habitat. Other important habitat components include spring seeps, especially in areas with regular snow cover, and an abundant supply of a diversity of soft mast producing plants (e.g., dogwood, black gum, grape, blueberry, etc). Quality turkey habitat will support one bird per 20 to 30 acres or one flock to about 640 acres (Yarrow and Yarrow 1999).

For the southern pine region, Hurst and Dickson (1992) recommended that at least 15% of the area should be kept in mature hardwoods such as streamside zones or pine-

hardwood corridors. Low density vegetation found in fallow fields, power line rights-of-way and forest openings; and provision of soft mast species also are important habitat components. Pine plantations should be thinned frequently and burned on a 3-to-5 year rotation to enhance herbaceous vegetation and soft mast production.

Eastern wild turkeys are present throughout the Southern Appalachian Assessment area. Population densities generally are medium to high in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, and Southern Appalachian Piedmont sections, and low to medium in the remainder of the SAA area (SAMAB 1996: 60-61). Within its range the wild turkey population has increased by more than 1 million birds between 1985 and 1990 (Long 1988). In 1991, there were about 4 million turkeys, 1 million more than existed 5 years earlier (Keck and Langston 1992). High population densities are associated with greater amounts of oak forest and cropland, and lesser amounts of developed and coniferous forestland. Current turkey densities appear to be on a gradual decline on public lands in the mountains. One of the factors contributing to the slow decline of turkey in the Andrew Pickens Ranger District is the lack of early successional habitats not associated with a maintained road, or private agricultural land uses. Turkey populations in the piedmont however appear to be on a steady increase across the forest.

The number of turkey hunting permits issued in South Carolina has increased 10-fold statewide since 1973. Turkey harvest has also increased dramatically from 536 birds reported in 1973 to 16,348 harvested in 2002 (SCDNR data). Both the direct and indirect economic benefits of hunting wild turkey have annually exceeded $500 million (Baumann et.al. 1989).

Direct and Indirect Effects

As discussed above, wild turkey require a mixture of forest/successional stage habitats to meet their year-round habitat needs. Key requirements include the interspersion of mature mast producing stands during fall and winter, shrub dominated stands for nesting, and herb dominated communities, including permanent openings for brood-rearing. Disturbance also may be a concern during the nesting season. The effects of each of the alternatives on these key habitat features are discussed in detail in previous sections (Mesic Deciduous Forest, Oak and Oak-Pine Forest, Mix of Early and Late Successional Forests). In general, alternatives that have high levels of thinning and burning (B, E, & I), active thinning, harvest or restoration strategies (A, B, D, E, F, I), increasing abundance of oak across the forest (A, D, I), an emphasis on permanent openings (F, E), and woodland savanna habitats (A, D, I) would be beneficial to turkey.

Cumulative Effects

Increased urbanization and declines in agricultural land uses in and around the Sumter National Forest are reducing habitat quality and limiting expansion of turkey populations in the piedmont and the mountains. Less forest area in early successional stages and

poorly distributed forest openings is also limiting the potential of turkey populations on the forest, especially in the mountains.

Ruffed Grouse

Affected Environment

On the Sumter National Forest, the ruffed grouse range is limited to the Andrew Pickens Ranger District.

Ruffed grouse utilize a variety of forest habitats and successional stages. Nesting cover generally is located in pole timber or larger hardwood stands (Harris 1981, Thompson and Dessecker 1997). Haney (1996) also reported use of old-growth cove hardwood forests in the Southern Appalachians for nesting and brood rearing. While nesting habitat does not appear to be limiting, close interspersion with secure adult cover and brood habitat is important (Thompson and Dessecker 1997).

Key features of brood cover are security and an abundant high protein food source. Insects are most abundant in habitats characterized by lush herbaceous vegetation (Dimmick et.al. 1996). Thompson and Dessecker (1997) describe brood cover as 3-7 year-old regenerating stands containing significant herbaceous component and shrub-dominated old fields and herbaceous openings. In Georgia, broods preferred upland hardwood sapling (>10 year-old) and pole timber habitats, but also used sawtimber stands, although not in proportion to availability (Harris 1981). Regeneration areas (<6 years-old) and evergreen shrub thickets were avoided. Brood habitats were characterized by dense and diverse herbaceous vegetation that provided low overhead cover with freedom of movement beneath. Dimmick et. al. (1996) suggest that the lack of interspersion of areas with a well developed herb layer and areas of high stem density for protective cover may be one of the limiting factors in southeastern grouse populations. They suggest that brood habitat could be enhanced by the conversion of logging roads and log landings to linear food plots by planting clover/grass mixtures, which will provide bugging areas in close proximity to secure cover.

Adult cover, including drumming habitat usually consists of young regenerating forest (6-15 years-old) or shrub cover (Thompson and Dessecker 1997). The dense cover provides protection from both avian and mammalian predators. Secure cover is provided in habitats with good vertical structure (8,000+ stems/acre) of 15-20 foot saplings (Kubisiak 1989). Dimmick et. al. (1996) reported that males began to orient their drumming sites around or in clearcuts within 3 years post harvest. In Georgia, drumming habitat was associated with the presence of a relatively dense understory of heath shrubs, primarily flame azalea and mountain laurel (Hale et.al. 1982). No strong preference for timber types or stand condition classes was evident. Harris (1981) found that males preferred upland hardwood sawtimber, generally associated with evergreen shrub thickets during the breeding and post-breeding seasons.

Dimmick et. al. (1996) found that breeding male density (based on drumming counts) increased significantly in response to clearcutting in Tennessee. A similar response to timber harvest was reported from oak-dominated forests in Missouri (Wiggers et.al. 1992). Highest grouse densities occurred where 7-to-15 year-old hardwood regeneration comprised greater than 14% of the area.

In oak forests of the Central Hardwood region, Thompson and Dessecker (1997) recommended managing on an 80-year rotation, which would maintain approximately 15% of the forest in brood or adult cover (3-15 years old). Appropriate regeneration methods include clearcut, seedtree, and shelterwood methods. Residual basal areas should not exceed 20 ft^2/acre. Cutting units should be > 5 acres, and preferably 10-40 acres in size. Group selection is not recommended since the regeneration patches are too small to provide large enough patches of contiguous habitat. In Missouri, Kurzejeski et. al. (1987) also recommended managing oaks on an 80-year rotation, but suggested harvest units should be less than 20 acres in size. In another study in Missouri oak forests, Wiggers et. al. (1992) recommended maintaining more than 14% in 7- to15-year-old hardwood regeneration. Kubisiak (1985) recommended the use of shelterwood cuts or clearcuts of 20 acres or less, leaving designated groups or scattered oaks (residual basal area less than 20 ft^2) with potential as mast-bearers or den trees. Larger cuts up to 40 acres are acceptable if in linear strips.

Dominant fall and winter foods in the Southern Appalachians include leaves and fruits of greenbrier (*Smilax* *spp*.), the leaves of mountain laurel (*Kalmia latifolia*), fruits of grapes (*Vitis* *spp*.) and oaks (*Quercus* *spp*.), and Christmas fern (*Polystichum acrostichoides*) (Seehorn et.al. 1981). Similarly, Stafford and Dimmick (1978) reported that greenbrier, mountain laurel, and Christmas fern were the dominant fall and winter food items in the Southern Appalachian region of Tennessee and North Carolina. When available, acorns comprise a significant proportion of the diet (Seehorn et.al. 1981; Servello and Kirkpatrick 1987; Kirkpatrick 1989; Thompson and Dessecker 1997). They provide a high-energy food source during the critical winter period when forage quality is limited (Servello and Kirkpatrick 1987; Kirkpatrick 1989). However, lack of secure cover in open oak stands may limit their use by grouse (Stafford 1989, Thompson and Dessecker 1997). Kubisiak (1985) suggested that 40-60% of a compartment be maintained in stands of mast-bearing age.

Ruffed grouse are found primarily in the Northern Ridge and Valley, Allegheny Mountains, Northern Cumberland Mountains, Blue Ridge Mountains, Northern Cumberland Plateau, and Southern Cumberland Mountains (SAMAB 1996:66-67). Low density populations also extend into the adjacent portions of the Central Ridge and Valley, Southern Cumberland Plateau, Southern Ridge and Valley, and Southern Appalachian Piedmont. Population densities generally are moderate in the Blue Ridge Mountains and low to moderate elsewhere. Current grouse densities generally are higher on national forest lands, national parks, and the Cherokee Indian Reservation than on other ownerships. Grouse population densities have declined over the last 25 years. The declining trend likely is largely due to the reduction of forest cover in the sapling-pole successional class, which is important to this species.

The Andrew Pickens Ranger District is the southern edge of ruffed grouse range in eastern North America. Ruffed grouse populations are historically low on the district, but equally persistent. Currently, there is a considerable lack of preferred habitats on the Andrew Pickens District largely due to the lack of harvesting, thinning and prescribed burning over the last 20 years. Recent interest in burning woodland habitats in the mountains combined with southern pine beetle outbreaks (1995-96 and 2001–02) have created some opportunities for improving grouse habitat in some locations.

Direct and Indirect Effects

Although ruffed grouse use a variety of forest habitats and successional stages, population responses are most strongly tied to the availability of early successional forests, particularly hardwood shrub-seedling habitat. Alternatives with a majority of the Andrew Pickens Ranger District assigned to management prescription 8.A1 (Alt. I) would provide substantial improvements for establishing and maintaining quality habitat for ruffed grouse. Many of the other prescriptions (7E2, 10B) will provide suitable to optimal conditions for grouse through the development of early-successional forests in alternatives A, D, & E. More early successional forest discussion is found in the section on Mix of Early and Late Successional Forests.

Cumulative Effects

Little opportunity for ruffed grouse management exits in the mountains on lands in other than public ownership. Private land holdings are relatively small in acreage, quite often owned by absentee landowners, and harbor several summer retreat type developments or commercial endeavors (orchards, rafting, etc.). A survey of land uses in a representative area of the Andrew Pickens District identified less than 3% of private lands in preferred habitats for ruffed grouse (i.e., early successional forests). With few exceptions, it is not expected that private landowners will restore or manage to maintain significant amounts of high quality ruffed grouse habitat, which will tend to further concentrate grouse populations on public lands.

Migratory Birds

Affected Environment

Migratory birds have become a focus of conservation concern due to evidence of declining population trends for many species. To ensure that forest plan revision alternatives include provisions for migratory bird habitat, planning efforts included coordination with the Migratory Bird Office of the U.S. Fish and Wildlife Service and others under the umbrella of Partners in Flight (PIF). PIF is a cooperative effort involving partnerships among federal, state, and local government agencies, foundations, professional organizations, conservation groups, industry, the academic community and private individuals. It was launched in response to growing concerns about declines in populations of land bird species and to emphasize conservation of birds not covered by existing conservation initiatives.

PIF has developed Bird Conservation Plans for each physiographic area relevant to the national forest planning area. These plans are science-based, long-term, proactive strategies for bird conservation across all land ownerships and are designed to ensure long-term maintenance of healthy populations of native land birds. Forest Service biologists worked with PIF regional and local coordinators to identify key management issues and opportunities for high priority species on national forest lands, and developed related goals, objectives, and standards for incorporation into the draft revised forest plan. In addition, *The Southern National Forest's Migratory and Resident Landbird Conservation Strategy* (Gaines and Morris 1996) was also reviewed and incorporated into planning efforts. This strategy identifies priority species and provides a framework for monitoring populations. The monitoring program described in this document is currently being implemented, and would continue under all alternatives.

Because migratory and resident land birds are so ubiquitous and diverse, they are relevant to the majority of ecological communities and habitat elements considered during forest planning. As a result, provisions for these species are integrated into numerous plan objectives and standards focused on achieving desired habitat conditions. Effects of these provisions on ecological communities and associated species are addressed throughout the EIS. Effects to specific species of birds are addressed under appropriate sections for those chosen as management indicator species. In addition, all relevant conservation priority species, as identified by the U.S. Fish and Wildlife Service, are assessed under the terrestrial species viability evaluation.

The Andrew Pickens District of the Sumter National Forest falls completely within the Southern Blue Ridge physiographic area, and is covered by the PIF Bird Conservation Plan for the Southern Blue Ridge. Despite habitat protection on federal lands within the Southern Blue Ridge physiographic area, 30% of breeding species have declined sharply in the last 30 years, and an additional 18% have shown possible declines (Hunter et. al. 1999). Major issues identified in the plan for the Blue Ridge, as well as key land bird conservation issues that apply to the Andrew Pickens District are summarized below.

PIF Southern Blue Ridge Plan

Major Issues:

- Creating structural diversity in high elevation hardwoods.
- North slope old-growth restoration.
- Mature hemlock forest protection.
- Reduction of off-site white pine
- Creating structural diversity in mature mixed mesophytic forests.
- Restoration of native mountain pines.
- Maintenance of oak forests (regeneration, late successional forests, thin and burn mid successional stages).

Key Conservation issues:

1. Large patches of mature hemlock-white pine, northern hardwoods and mixed mesophytic (mesic hardwood) forests are uncommon due to past land management and elevation influences. Older stands of northern hardwood and mixed mesophytic hardwood forests cover about 24% of the Andrew Pickens Ranger District. With the exception of the Chattooga River Corridor, low elevation forests, especially riparian forests, are fragmented on private lands. Carolina hemlock forests are treated as rare communities in the Sumter National Forest plan; they will be maintained and restored across all alternatives. Forests dominated by eastern hemlock will not be subject to regeneration harvest. Hemlock will be retained as patches during all silvicultural treatments.

2. Many early successional species at mid- to high elevations have declined due to forest maturation, fire suppression, elimination of grazing, and decline in active forest management on federal lands. The Sumter National Forest has established objectives for early successional forest, permanent openings, and woodland/savanna habitats.

3. A predominance of forest stands in the 40-100 year age class on national forest lands has resulted in a closed canopy condition with poorly developed understory and sub-canopy. There is an overall lack of forest with "old growth" characteristics, including a multi-layered canopy, snags and downed woody debris. The Sumter National Forest established objectives for canopy gap creation to enhance the understory in uplands (see Mesic Deciduous Forests), and riparian habitats.

4. Development of private land to resort, urban and suburban uses is negatively affecting the ability to manage forest habitats at a landscape level.

The Enoree and Long Cane Districts of the Sumter National Forest fall completely within the Piedmont physiographic area, and are covered by the PIF Bird Conservation Plan for the Piedmont. Land use changes prior to national forest ownership drastically changed the vegetative landscape of the area. Farming practices associated with raising cotton, tobacco, and row crops triggered a considerable loss of soil in the clay hills of the piedmont. Remnants of shortleaf/bluestem, longleaf pine, and other fire adapted plant communities can still be found throughout this physiographic area. Major issues

identified in the plan for the piedmont, as well as key land bird conservation issues that apply to the Enoree and Long Cane Districts are summarized below.

PIF Piedmont Plan

Major Issues:

- Mix of mature riparian forest and patches of dense understory.
- Forest interior versus early successional habitat—emphasize early-successional habitat in pine forests.
- Native grassland/savanna/woodland restoration; shortleaf pine restoration.
- Wetland restoration.

Key Conservation Issues:

1. Intensification of agricultural and forest management practices has reduced open woodland, savanna and grasslands, as well as early successional habitats throughout the piedmont. Features such as hedgerows, field borders, and brushy abandoned fields have declined in numbers and size. Private forestlands, which occupy a vast majority of the piedmont, have been gradually converted to fast growing, dense stands of loblolly pine managed on relatively short rotations. The Sumter National Forest has established objectives for early successional forest; restoration of woodland savanna habitats; and, increases in mixed pine/hardwood stands on piedmont districts.

2. Urbanization is increasing in the piedmont of South Carolina. Once lands are converted to other uses, they are no longer available as habitats for a majority of forest wildlife species. Increases in urban development also negatively impact the ability to manage existing forested lands along the urban interface.

3. Restoration and consolidation of habitats in the piedmont requires cooperative efforts among the many public and private landowners in the area. Early successional habitats, riparian habitats, and forest interior habitats are the highest priority for management for migrating or breeding birds in the piedmont. Of particular interest is the recreation and restoration of water bird habitats in the piedmont for summer foraging, spring and fall migration, and wintering habitat for a wide variety of bird species.

In addition to providing a diversity of habitats for migratory birds on the landscape, collision of migratory birds with communications towers was also considered during plan revision. The U.S. Fish and Wildlife Service (2000) has identified this as an issue needing attention:

> "Construction of these towers (including radio, television, cellular, and microwave) increases at an estimated 6 to 8 percent annually in the United States. According to the Federal Communication Commission's *2000 Antenna Structure Registry*, the number of lighted towers greater than 199 feet above ground level (AGL) currently number over 45,000 and the total number of towers over 74,000. Non-compliance with the registry program is estimated at 24 to 38 percent, bringing the total to 92,000 to 102,000. By 2003, all television stations must be digital, adding potentially 1,000 new towers exceeding 1,000 feet AGL."…."The construction of new towers creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. Communications towers are estimated to kill 4-5 million birds per year."

Two mechanisms of bird mortality occur at communications towers (World Wide Web 2002). The first occurs when birds flying in poor visibility conditions do not see the structure (i.e., blind collision). Towers that are lighted at night for aviation safety may help reduce blind collisions, but they bring about a second mechanism for mortality. When there is a low cloud ceiling or foggy conditions, refracted light creates an illuminated area around the tower. Migrating birds lose their stellar cues for nocturnal migration and a broad orienting perspective on the landscape in these weather conditions. The lighted area may be the strongest cue for navigation, and birds remain in the lighted space by the tower. Mortality occurs when they collide with the structure and guy wires, or even other migrating birds, as more and more passing birds occupy the relatively small, lighted space. The lights apparently do not attract birds from afar, but hold birds that pass within the vicinity.

Because migratory birds cover such large areas, their conservation is dependent on the distribution of suitable habitats across large regions. Currently, national forests provide some of the largest blocks of forested habitat when viewed at a physiographic area scale. As habitat quality and quantity continues to change on many privately-owned lands due to conversion to urban and suburban land uses, national forest lands will become even more important to migratory birds in the future. Efforts by the Forest Service to coordinate closely with partners in bird conservation and to incorporate proactive conservation measures into forest plan revisions are designed to ensure national forests continue to support at-risk migratory birds.

Direct, Indirect and Cumulative Effects

The key to providing habitat for migrating species is a landscape where suitable habitats dominate.

For waterfowl, wading birds and colonial nesting birds that means substantial areas of mud flats, shallow water and some deep-water habitats along migration corridors (Broad

River and Savanna River systems on the Sumter). Increases in these habitats would also benefit dispersal of some listed species such as wood stork and bald eagle. Alternatives B, E, F and I place an emphasis on creating and restoring wetlands and “water bird” habitats. All alternatives recognize beaver ponds as important elements in providing wetland and associated habitats. The potential for summer foraging habitat for wood stork in the piedmont is expected to be high in Alternatives B, F, and I, and greatest in Alternative E. Likewise the potential for providing high quality wintering and stop-over habitat for migrating water birds is high in Alternatives B, F, and I and greatest in Alternative F.

For migratory songbirds, a mosaic of habitats in a landscape with connections to similar habitats is essential to replenish fat reserves for neotropical migrants passing through the forest, important to reproductive success for summer breeding populations, and crucial to over-wintering species in achieving good reproductive condition prior to migration. Habitats with high amounts of persistent hard seed from herbaceous plants, grains and some grasses (on the ground or still on the stem), fall fruits (dogwood, grape, black cherry), early spring bud and seed producers such as elm and maple, and woody plants with persistent fruit (sycamore, black gum, grape) are important to this group. Alternatives with an emphasis on a diversity of forested habitats, including woodland/savanna development and providing canopy gaps would be more capable of providing and sustaining adequate habitats for migratory songbirds. Alternatives F, B, E, and I have the greatest opportunities to provide quality habitats for these and associated species, including raptors.

For migratory game birds (mourning dove and woodcock), the presence of grasslands, shrubland, agriculture, and early successional forests are essential. Bare ground and an abundance of small seeds for doves, and grassy areas with shrubs and an abundance of earthworms for woodcock are the determining factors if they are present or not. Both species migrate in large numbers through the forest in the spring and fall, and both species are resident summer breeders. Woodcock are generally low in numbers and poorly distributed across the forest during the breeding season. Doves are much more common on the forest and nesting habitat (cedars, scattered pines, open woodland/savanna conditions) in close proximity to food sources is a valuable habitat characteristic. Several permanent wildlife openings are managed cooperatively with the SCDNR specifically for doves. (Woodcock are discussed in more detail in the section Demand Species.) Alternatives with an emphasis on permanent openings (F, E), restoring woodland/savanna conditions ((B, D, E, I), and providing early successional forest conditions (A, D, F, and I) would have the greatest benefit for these species.

Species Viability

Terrestrial Species Viability Evaluation

Affected Environment

National Forest Management Act (NFMA) regulations, adopted in 1982, require that habitat be managed to support viable populations of native and desirable non-native vertebrates within the planning area (36 CFR 219.19). USDA regulation 9500-004, adopted in 1983, reinforces the NFMA viability regulation by requiring that habitats on national forests be managed to support viable populations of native and desired non-native plants, fish, and wildlife. These regulations focus on the role of habitat management in providing for species viability. Supporting viable populations involves providing habitat in amounts and distributions that can support interacting populations at levels that result in continued existence of the species well-distributed over time.

The Southern Appalachian region supports extremely high levels of biological diversity relative to other regions, viewed both nationally and globally. As a result, large numbers of species are present for which population viability may be of concern. Detailed demographic or habitat capability analysis to evaluate population viability is not feasible for this large number of species. Therefore, our goal for this evaluation is to use a clearly defined, transparent process to identify species for which there are substantive risks to maintenance of viable populations, and to ensure consideration of appropriate habitat management strategies to reduce those risks to acceptable levels where feasible.

For comprehensiveness and consistency, evaluation of species viability was coordinated across several national forests undergoing simultaneous plan revisions. These forests are the Jefferson National Forest, Cherokee National Forest, Sumter National Forest, Chattahoochee and Oconee National Forests, and National Forests in Alabama. These forests encompass portions of the Southern Appalachian, Piedmont, and East Gulf Coastal Plain ecoregions. However, the scale for this assessment is set by NFMA regulations as the “planning area,” or the area of the National Forest System covered by a single forest plan. Therefore, separate risk assessment was done for each national forest covered by a separate forest plan. Risk assessment was further split where national forest units under the same forest plan occur in different ecoregions, or are widely separated geographically. The Sumter National Forest includes into piedmont (Enoree and Long Cane districts) and Southern Blue Ridge (Andrew Pickens district). Although viability evaluation was coordinated across the ecoregions, analysis presented here focuses on information relevant to the Sumter National Forest.

Because NFMA regulations require providing habitat for species viability within the planning area, focus of this evaluation is on habitat provided on national forest land. Surrounding private lands may contribute to, or hinder, maintenance of species viability on national forest land, but are not relied upon to meet regulation requirements. For this reason, habitat abundance was assessed based on conditions found on national forest

land. Habitat distribution, however, was assessed considering the condition of intermixed ownerships and conditions, which may affect the interactions of species among suitable habitat patches on national forest land.

Evaluation of migratory birds focused on breeding populations only, unless otherwise indicated. This focus does not mean that wintering and migrating populations were not considered during planning, but that viability evaluation makes most sense when viewed in terms of the relative stability of breeding populations.

NatureServe, under a Participating Agreement with the Forest Service, compiled much of the foundational information used in this evaluation. NatureServe is an international non-profit organization, formerly part of The Nature Conservancy. Its mission is to develop, manage, and distribute authoritative information critical to conservation of the world's biological diversity. Partnership with NatureServe was sought as a means to ensure the best available information on species status and habitat relationships was used in this evaluation. Under this agreement, NatureServe staff engaged numerous species experts and state heritage programs to develop a relational database that includes relevant information on species' status, habitat relationships, and threats to viability.

Viability Evaluation Process

Risk to maintenance of viability over the next 50 years was assessed for each species in relation to each of its principle habitat relationships by plan revision alternative. Risk assessment was based on three factors: 1) current species abundance, 2) expected habitat abundance in 50 years, and 3) expected habitat distribution in 50 years (Figure 1). Once risk ratings were developed, we assessed how well management strategies across alternatives provide for species viability.

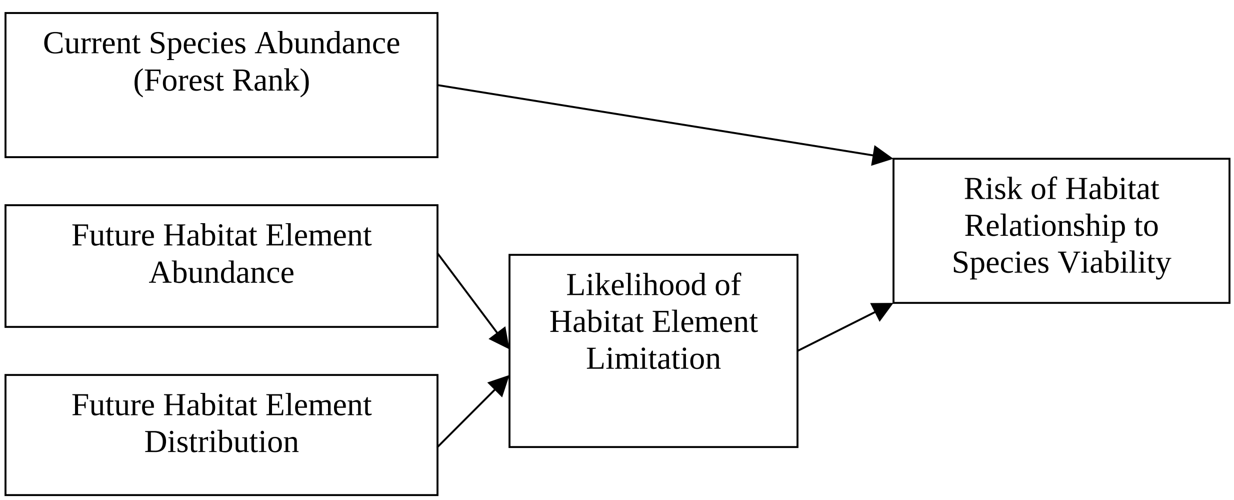


Figure 3-9. Relationship of variables used to rate the risk to viability resulting from a species' relationship with a habitat element.

A comprehensive list of species with potential viability concern was compiled for the Sumter National Forest. The list includes those species found, or potentially found, on the National Forest from the following categories:

- Species listed as proposed, threatened, or endangered under the federal Endangered Species Act,
- Species listed on the Regional Forester's Sensitive Species list,
- Species identified as locally rare on the National Forest by Forest Service biologists, including state threatened and endangered species,
- Birds of conservation concern as identified by the US Fish and Wildlife Service, and
- Declining species of high public interest.

Species lists from all national forests in the Southern Appalachian and Piedmont Eco-regions in South Carolina, were pooled to create comprehensive lists of species of potential viability concern. NatureServe staff and contractors assigned abundance ranks for each species on the comprehensive eco-region list for the piedmont districts and the Andrew Pickens district of the Sumter National Forest. These Forest Ranks, or F Ranks, follow the conventions used by NatureServe and others in defining State and Global Ranks (Table 3-56).

F Ranks were used in viability risk assessment as a categorical variable representing a species' current abundance. Forest Service biologists reviewed F Ranks developed by NatureServe to identify any inconsistencies between these rankings and Forest Service information. Discrepancies in this abundance variable were resolved through coordination with NatureServe and its contractors. Where conflicting information or opinion on species abundance occurs, the most conservative information (i.e., that indicating lowest abundance) was used.

Only those species that are both confirmed present and rare or of unknown abundance (F1 through F3, and F?) on the Sumter National Forest were assessed for viability risk. Species ranked as F? were treated as F1 species to provide a conservative approach to those species for which abundance information is not available. Species that are currently abundant on the forest (F4, F5) are assumed to be at low risk of losing viability within the next 50 years, and, therefore, were not further evaluated for viability risk.

Table 3-56. Forest Ranks (F Ranks) and definitions used to define status of species on piedmont and Andrew Pickens districts of the Sumter National Forest as part of species viability evaluation for forest plan revision, 2002.

F Rank	F Rank Definition
F0	Not present; no known occurrences on the forest unit, and forest is outside species' range or habitat not present.
F1	Extremely rare on the forest unit, generally with 1-5 occurrences.
F2	Very rare on the forest unit, generally with 6-20 occurrences.
F3	Rare and uncommon on the forest unit, from 21-100 occurrences.
F4	Widespread, abundant, and apparently secure on the forest unit.
F5	Demonstrably secure on the forest unit.
F?	Present on the forest, but abundance information is insufficient to develop rank.
FP	Possibly could occur on the forest unit, but documented occurrences are not known.
FH	Of documented historical occurrence on the forest unit; may be rediscovered.
FX	Once occurred but has been extirpated from the forest unit; not likely to be rediscovered.

Because viability regulations focus on the role of habitat management in providing for species viability, habitat condition was the primary factor used to drive species viability evaluation. NatureServe staff and contractors identified habitat relationships for all species of potential viability concern, linking each species to vegetation community types, successional stages, and habitat attributes as appropriate. Based on this information, each species was linked by Forest Service biologists to one or more habitat elements. These habitat elements (Table 3-57) roughly correspond to categories of management direction included in the draft revised plan, and to sections of effects analysis included in this environmental impact statement. NatureServe staff reviewed and provided adjustments to species' assignment to these habitat element groups.

Table 3-57. Habitat elements used to plan for, and assess risk to, viability of terrestrial species during forest plan revision, Sumter National Forest.

Habitat Element	Element Description
Bogs, Fens, Seeps, Seasonal Ponds	Bogs, fens, seeps, seasonal ponds characterized by saturated soils
Open Wetlands	Open wetlands, marshes, beaver ponds, generally characterized by having some permanent standing water
River Channels	Riverine gravel and sand bars, and river banks subject to flood scour
Glades and Barrens	Glades and barrens characterized by shallow soils, exposed parent material, and sparse or stunted vegetation
Table Mountain Pine Forests	Forests and woodlands dominated by table mountain pine and maintained by periodic fire

Basic Mesic Forests	Basic mesic or "rich cove" forests characterized by calciphilic herbs and usually dominated by maples, basswood, and buckeye.
Rock Outcrops and Cliffs	Rock outcrops and cliffs characterized by exposed rock, shallow soils and sparse vegetation
Spray Cliffs	Rock that remains wet for all or most of the year, associated with waterfalls or seepage
Canebrakes	Canebrakes characterized by dense stands of cane and open canopies, usually within riparian areas
Caves and Mines	Caves and mines with microclimates capable of supporting associated biota
Mature Mesic Hardwood Forests	Mid- and late-successional mesic deciduous forests, including northern hardwood, mixed mesophytic, mesic oak, and bottomland hardwood forests
Mature Hemlock Forests	Mid- and late-successional eastern hemlock and eastern hemlock-white pine forests in native settings, typically on stream terraces and other mesic sites
Mature Oak Forests	Dry to mesic mid- and late-successional oak and oak-pine forests subject to moderate levels of disturbance sufficient to maintain the oak component
Mature Yellow Pine Forests	Mid- and late-successional southern yellow pine and pine-oak forests maintained in open conditions by frequent fire
Early-Successional Forests	Early-successional forests, typically aged 0-10 years and dominated by woody species
Mature Forest Interiors	Mature forest interiors with minimal adverse effects due to forest edge.
Canopy Gaps	Mid- and late-successional mesic deciduous forests with a diverse vertical and horizontal structure as a result of gaps in the canopy
Woodlands and Savannas	Open woodlands and savannas characterized by low canopy cover and rich grass-dominated understories, and maintained in open conditions by periodic fire
Grasslands	Grasslands with little to no overstory, usually occurring as patches within woodland and savanna complexes and maintained by periodic fire
Mixed Landscapes	Landscapes characterized by a broad mix of successional habitats
Late Successional Riparian	Riparian areas dominated by mid- and late-successional deciduous forests
Early-Successional Riparian	Riparian areas with a dense understory or early-successional forest in riparian areas
Snags	Forests containing an abundance of snags

Downed Wood	Forests containing an abundance of downed wood and thick leaf litter
Den Trees	Forests containing an abundance of large hollow trees suitable as den trees
Hard Mast	Forests producing abundant hard mast
Remoteness	Remote habitats away from frequent human disturbance
Lakeshores	Forested shores of lakes and ponds
Water Quality	High water quality in streams and lakes

Effects to these habitat elements are analyzed in this EIS under other sections. Based on these analyses, each habitat element was assigned categorical values by alternative to indicate future abundance (Table 3-58) and distribution (Table 3-59), general likelihood that the habitat element would limit viability of associated species (Table 3-60), and overall effect of national forest management on the habitat element (Table 3-61).

The future abundance variable (Table 3-58) is defined as the abundance of the associated habitat element in fifty years if the alternative were selected and implemented over that fifty-year period. This variable indicates the abundance of the habitat element on national forest land only, to provide focus on the role of the national forest planning area in supporting associated species. Its focus on national forest land only reflects recognition that viability is to be provided within the "planning area" (area covered by the forest plan). Definitions of abundance categories are stated in quantifiable terms in order to be objective as possible; however, in many cases quantifiable estimates of future abundance are not available. In these cases, knowledge of Forest Service biologists was used to assign abundance values based on current conditions and the magnitude and direction of effects expected under each alternative.

Table 3-58. Values used to categorize projected abundance of each habitat element after 50 years of implementing each forest plan revision alternative.

Habitat Abundance Value	Description
Rare	The habitat element is rare, with generally less than 100 occurrences, or patches of the element generally covering less than 1 percent of the national forest planning area.
Occasional	The habitat element is encountered occasionally, and generally is found on 1 to 10 percent of the national forest planning area.
Common	The habitat element is abundant and frequently encountered, and generally is found on more than 10 percent of the national forest planning area.

Similar to the future abundance variable, the future distribution variable (Table 3-59) is defined as the distribution of the associated habitat element in fifty years if the alternative were selected and implemented over that fifty-year period. In contrast to the abundance variable, it includes consideration of intermixed ownership patterns and conditions, and their general effects on movements and interactions of individuals among the suitable habitat patches found on national forest land. Because assessing adequacy of habitat distribution for a species requires a level of knowledge not available for most species, and the number of species being evaluated is very large, we have defined habitat distribution in terms of a historical reference condition—that which was present prior to the major perturbations associated with European settlement of the planning area. This period is generally defined as 1000 to 1700 A.D. This approach relies on the assumption that a habitat distribution similar to that which supported associated species during recent evolutionary history will likely contribute to their maintenance in the future, and that the further a habitat departs from that historical distribution, the greater the risk to viability of associated species. This approach has its own set of difficulties, as evidence of presettlement conditions relevant to the planning area is often anecdotal and scarce. In addition, the reference period may have included a wide variety of conditions as a result of growing aboriginal populations and accompanying use of agriculture and fire during the early portion of this period, and their subsequent dramatic decline due to disease epidemics following early European contact. Nevertheless, the precision required to assign the categorical values for this variable is not high, and may be supported by general positions described in mainstream conservation literature (see Wear and Greis 2002). Knowledge of Forest Service biologists was used to assign distribution values, based on interpretations of historical conditions supported by conservation literature, current conditions, and magnitude and direction of effects expected under each alternative.

Differences in scale between the Habitat Abundance and Habitat Distribution variables is intentional in order to bring two different pieces of information into the analysis. Habitat Abundance has been defined in terms of the amount of habitat on national forest land only. This definition reflects the amount of habitat available to support a species on the national forest, in recognition of regulation requirements that viability be provided within the "planning area" (area covered by the forest plan). Habitat Distribution, on the other hand, is defined to include the landscape setting of national forest lands, which includes the intermingled private lands and broken ownership patterns that provides the context for national forest populations and may affect ability of individuals living on national forest lands to interact with each other.

Table 3-59. Values used to categorize projected distribution of each habitat element after 50 years of implementing each forest plan revision alternative.

Habitat Distribution Value	Description
Poor	The habitat element is poorly distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is greatly reduced.
Fair	The habitat element is fairly well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is somewhat reduced.
Good	The habitat element is well distributed within the planning area and intermixed lands relative to conditions present prior to European settlement. Number and size of habitat patches and/or their evenness in distribution across the landscape is similar to or only slightly reduced relative to reference conditions.

Habitat element abundance and distribution variables were combined to create one variable to indicate the general likelihood that the habitat element would be limiting to populations of associated species (Table 3-60). In this general context, habitat limitation refers to a habitat factor—quantity, distribution, or quality—that results in risk to continued existence of the species within the planning area. Everything else being equal, quality habitat elements that are rare and poorly distributed are those most likely to cause risk to viability of associated species; those that are common and well distributed are least likely to cause risk to viability of associated species.

Table 3-60. Likelihood of habitat limitation (High, Moderate, and Low) to associated species as derived from habitat abundance and distribution values.

Habitat Abundance	Habitat Distribution		
	Poor	Fair	Good
Rare	High	High	Moderate
Occasional	High	Moderate	Low
Common	Moderate	Low	Low

Providing for species viability requires providing abundant and well-distributed habitat in ways that allow existing populations to persist or expand. The ability of existing populations to respond to available habitat depends in part on their current robustness, which is generally a function of population size. In general, for a given habitat condition, small populations will be at more risk than large populations. To reflect this fact, likelihood of habitat limitation variable was combined with a species' F Rank for each species/habitat element interaction to generate viability risk ratings (Table 3-61). Associations of very rare species with habitat elements that are likely to be most limiting were identified as those most at risk; associations of more common species with habitats

less likely to be limiting received lower risk ratings. Ratings include three levels of “high” risk (Table 3-61) to ensure that results err on the side of caution.

Table 3-61. Viability risk ratings for species/habitat interactions as a function of a species’ F Rank and likelihood of habitat element limitation variables.

Likelihood of Habitat Element Limitation	Species F Rank		
	F1 or F?	F2	F3
High	Very High	High	Moderately -High
Moderate	High	Moderately-High	Moderate
Low	Moderately-High	Moderate	Low

Once viability risk ratings were developed for each species/habitat relationship, habitat elements most commonly associated with risks to species viability were identified by counting the number of very high, high, and moderately high ratings associated with each. To assess the role of national forest management in minimizing viability risk associated with each habitat element, a management effects variable was assigned to each habitat element by alternative. The management effects variable (Table 3-62) categorizes the goal of management for the habitat element, the expected resulting trend, and any additional opportunity for minimizing viability risk. Numbers of very high, high, and moderately-high risk ratings were summarized by management effects variable by alternative to assess how well alternatives address viability-related habitat needs.

Table 3-62. Values used to categorize the effect of national forest management in minimizing or contributing to species viability risk associated with each habitat element by forest plan revision alternative.

Management Effect Value	Description
1	Abundance and distribution of the habitat element is maintained or improved by providing optimal protection, maintenance, and restoration to all occurrences (with limited exceptions in some cases). Little additional opportunity exists to decrease risk to viability of associated species because management is at or near optimal.
2	Abundance and distribution of the habitat element is improved through purposeful restoration, either through active management or passively by providing for successional progression. Opportunity for decreasing risk to associated species is primarily through increasing rates of restoration, where possible.
3	The habitat element is maintained at approximately current distribution and abundance, though location of elements may shift over time as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to increase abundance and distribution of the habitat element.
4	Regardless of management efforts, the habitat element is expected to decrease in distribution and abundance as a result of factors substantially outside of Forest Service control (e.g., invasive pests, acid deposition). Opportunity to reduce risk to viability of associated species is primarily through cooperative ventures with other agencies and organizations.
5	The habitat element is expected to decrease in distribution and abundance as a result of management action or inaction. Opportunity to reduce risk to viability of associated species is primarily through adopting and implementing objectives to maintain or increase this habitat element.

Distribution of viability risk was also summarized by species status, i.e., federally listed under the Endangered Species Act, listed as Regional Forester's sensitive species, or identified as locally rare or of other concern. The species status summary highlights the relative role of other provisions included in law and policy that result in additional consideration of at-risk species during planning.

Direct, Indirect and Cumulative Effects (Viability Evaluation Results)

Species viability evaluation for the Sumter National Forest included consideration of 151 species of the Southern Appalachian ecoregion and 39 species of the Piedmont ecoregion. Of these species, 21 species from the Southern Appalachian ecoregion and 13 species from the Piedmont ecoregion are either federally list or Regional Forester Sensitive Species known to occur on the Sumter National Forest.

Outcomes for habitat elements, as described under individual effects analysis sections, are summarized in Appendix F, Table F-1, using the four variables described in Table F-1

Key to Variables. These variables indicate expected habitat condition following fifty years of implementing each forest plan revision alternative.

Ratings of risk to viability for each species/habitat relationship by alternative are presented in Appendix F, Table F-2. To facilitate comparison of effects of alternatives on species viability, the number of very-high, high, and moderately-high risk ratings are summarized for each alternative by habitat element (Table 3-63 and 3-64), management effect (Tables 3-65 and 3-66), and species status (Table 3-67 and 3-68).

Viability risk rating summaries indicate relatively small differences among alternatives relative to effects on species viability. This similarity results from planning efforts to include in all alternatives provisions to provide for species viability in compliance with NFMA regulations. Examples of such provisions common to all alternatives (except Alternative F, which represents the current forest plan) are the prescriptions for rare communities and riparian corridors. Similarity of viability outcomes among alternatives also results from the influence of external forest health threats, which represent serious risks to forest communities and associated species regardless of alternative. Differences among alternatives are also muted by the small scale of actions contemplated under all alternatives relative the more extensive effects to ecological systems that have occurred to national forest landscapes since European settlement. Broader scale effects will likely continue to have similar important effects to species viability regardless of which alternative is selected.

Evaluation results indicate, under all alternatives, high levels of risk to species viability are associated with certain key habitats (Table 3-63- and 3-64). Highest risks are associated with 1) bogs, fens, seeps, and seasonal ponds, 2) mature mesic hardwood forests, 3) rock outcrops and cliffs, 4) woodlands, savannas, and grasslands on the Andrew Pickens, 5) Late successional riparian. Highest levels of risk are associated with 1). Mature mesic hardwood forests, 2) Basic mesic forests, 3) Mature oak forests, woodlands, and savannas, and 4) Late successional riparian on the piedmont districts.

Bogs, fens, seeps, and seasonal ponds are critical to maintaining species viability due to their natural rarity on the landscape, their decline during European settlement due to beaver control and drainage for agriculture, and the number of rare species associated with them. Provisions for the rare community prescription provide for optimal protection and management of all occurrences of these habitats under all alternatives except Alternative F; therefore, opportunities for further reducing risk to viability associated species are limited. Under Alternative F such habitats would likely be maintained, but would not receive the focused attention provided by the rare community prescription.

Mature mesic hardwood forests and late successional riparian forests are fairly common on the Andrew Pickens, but many are even-aged having established themselves following extensive clearing during the late 19th and early 20th centuries. High quality mature mesic forests are rare, due to the decline of American chestnut, and the low structural diversity typical of even-aged stands. On the piedmont, high quality mature mesic and basic mesic hardwood forests are relatively uncommon due to past land use and conversion to pine.

Many mature mesic and late successional riparian forests lack the hard mast (oak) component they had prior to European settlement.

On the Andrew Pickens, the many locally rare species associated with waterfall spray zones are included in with the rock outcrop and cliff rare community. These species are typically vulnerable due to recreational use in these areas and competition with non-native invasive plants. On both the Andrew Pickens and piedmont districts, the woodlands, savannas, and grasslands are much reduced compared to presettlement (Cecil Frost, personal comment), due to lack of frequent prescribed fire.

Table 3-63. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each habitat element by forest plan revision alternative, Andrew Pickens Ranger District of the Sumter National Forest.

	Alternative						
Habitat Element/Risk	A	B	D	E	F	G	I
Bogs, Fens, Seeps, Seasonal Ponds							
Very High	20	20	20	20	20	20	20
High	6	6	6	6	6	6	6
Moderately High	3	3	3	3	3	3	3
Total	29	29	29	29	29	29	29
Open Wetlands							
Very High	3	3	3	3	3	3	3
High	2	2	2	2	2	2	2
Moderately High	1	1	1	1	1	1	1
Total	6	6	6	6	6	6	6
River Channels							
Very High	1	1	1	1	1	1	1
High	0	0	0	0	0	0	0
Moderately High	3	3	3	3	3	3	3
Total	4	4	4	4	4	4	4
Glades and Barrens							
Very High	3	3	3	3	3	3	3
High	3	3	3	3	3	3	3
Moderately High	3	3	3	3	3	3	3
Total	9	9	9	9	9	9	9
Table Mountain Pine Forests							
Very High	2	2	2	2	2	2	2
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	3	3	3	3	3	3	3
Basic Mesic Forests							
Very High	8	8	8	8	8	8	8
High	5	5	5	5	5	5	5
Moderately High	2	2	2	2	2	2	2
Total	15	15	15	15	15	15	15

Rock Outcrops and Cliffs							
Very High	0	0	0	0	0	0	0
High	17	17	17	17	17	17	17
Moderately High	5	5	5	5	5	5	5
Total	22	22	22	22	22	22	22
Spray Cliffs							
Very High	0	0	0	0	0	0	0
High	4	4	4	4	4	4	4
Moderately High	2	2	2	2	2	2	2
Total	6	6	6	6	6	6	6
Canebrakes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Caves and Mines							
Very High	0	0	0	0	0	0	0
High	4	4	4	4	4	4	4
Moderately High	0	0	0	0	0	0	0
Total	4	4	4	4	4	4	4
Mature Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	25	25	25	25	25	25	25
Total	25	25	25	25	25	25	25
Mature Hemlock Forests							
Very High	7	7	7	7	7	7	7
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	9	9	9	9	9	9	9
Mature Oak Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	6	6	6	6	6	6	6
Total	6	6	6	6	6	6	6
Mature Yellow Pine Forests							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	2	2	2	2	2	2	2
Total	4	4	4	4	4	4	4
Early-Successional Forests							
Very High	0	0	0	0	0	1	0
High	0	0	0	1	0	2	0
Moderately High	1	1	1	2	1	1	1
Total	1	1	1	3	1	4	1
Mature Forest Interiors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0

Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Canopy Gaps							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Woodlands, Savannas, and Grasslands							
Very High	0	0	0	0	9	0	0
High	9	9	9	9	12	9	9
Moderately High	12	12	12	12	5	12	12
Total	21	21	21	21	26	21	21
Mixed Landscapes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Late Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	19	19	19	19	19	19	19
Total	19	19	19	19	19	19	19
Early-Successional Riparian							
Very High	0	1	0	1	1	1	0
High	1	0	1	0	0	0	1
Moderately High	0	2	0	2	2	2	0
Total	1	3	1	3	3	3	1
Snags							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Downed Wood							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	4	4	4	4	4	4	4
Total	4	4	4	4	4	4	4
Den Trees							
Very High	0	0	0	0	0	0	0
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Hard Mast							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Remoteness							

Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Lakeshores							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Water Quality							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
All Habitats							
Very High	44	45	44	45	54	46	44
High	59	58	59	59	61	60	59
Moderately High	95	97	95	98	90	97	95
Total	198	200	198	202	205	203	198

Table 3-64. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each habitat element by forest plan revision alternative, Piedmont Districts of the Sumter National Forest.

	Alternative						
Habitat Element/Risk	A	B	D	E	F	G	I
Bogs, Fens, Seeps, Seasonal Ponds							
Very High	1	1	1	1	1	1	1
High	1	1	1	1	1	1	1
Moderately High	1	1	1	1	1	1	1
Total	3	3	3	3	3	3	3
Open Wetlands							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
River Channels							
Very High	2	2	2	2	2	2	2
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	2	2	2	2	2	2	2
Glades and Barrens							
Very High	2	2	2	2	2	2	2
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	3	3	3	3	3	3	3
Basic Mesic Forests							
Very High	0	0	0	0	6	0	0
High	6	6	6	6	1	6	6
Moderately High	1	1	1	1	0	1	1
Total	7	7	7	7	7	7	7
Rock Outcrops and Cliffs							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Canebrakes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Mature Mesic Hardwood Forests							
Very High	0	0	0	0	0	0	0
High	5	5	5	5	5	5	5
Moderately High	3	3	3	3	3	3	3
Total	8	8	8	8	8	8	8
Mature Oak Forests							
Very High	0	0	0	0	0	0	0
High	3	3	3	3	3	3	3

Moderately High	3	3	3	3	3	3	3
Total	6	6	6	6	6	6	6
Mature Yellow Pine Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Early-Successional Forests							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Mature Forest Interiors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Canopy Gaps							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2
Woodlands, Savannas, and Grasslands							
Very High	0	0	0	0	3	0	0
High	3	3	3	3	1	3	3
Moderately High	1	1	1	1	4	1	1
Total	4	4	4	4	8	4	4
Mixed Landscapes							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Late Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	5	5	5	5	5	5	5
Total	5	5	5	5	5	5	5
Early-Successional Riparian							
Very High	0	0	0	0	0	0	0
High	0	1	0	1	1	1	0
Moderately High	1	1	1	1	1	1	1
Total	1	2	1	2	2	2	1
Snags							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Downed Wood							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0

Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
Den Trees							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Hard Mast							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Remoteness							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Lakeshores							
Very High	0	0	0	0	0	0	0
High	1	1	1	1	1	1	1
Moderately High	0	0	0	0	0	0	0
Total	1	1	1	1	1	1	1
Water Quality							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	1	1	1	1	1	1	1
Total	1	1	1	1	1	1	1
All Habitat Elements							
Very High	5	5	5	5	14	5	5
High	20	21	20	21	14	21	20
Moderately High	25	25	25	25	27	25	25
Total	50	51	50	51	55	51	50

All alternatives, with the exception of Alternative F, are expected to provide for the optimal protection and management of all habitat occurrences and to improve habitat abundance and distribution through restoration (Table 3-65 and Table 3-66). Alternative F will provide for species viability primarily through habitat maintenance, resulting in slightly more species/habitat relationships rated as very high, high, or moderately high risk to terrestrial species viability.

Only Alternative D would reduce habitat elements with high risk species relationships as a direct result of management. These associations involve mature mesic deciduous forests (both Andrew Pickens and piedmont) and mature oak forests (piedmont only), and the structural diversity of canopy gaps found in older age classes of these forests. All other alternatives are expected to maintain or increase levels of these habitat elements.

Table 3-65. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each category of management effect by forest plan revision alternative, Andrew Pickens Ranger District, Sumter National Forest.

Management Effect/Risk	Alternative A	B	D	E	F	G	I
Provide Optimal Protection and Management for All Habitat Occurrences							
Very High	35	35	35	35	0	35	35
High	42	42	42	42	5	42	42
Moderately High	20	20	20	20	1	20	20
Total	96	96	96	96	6	96	96
Improve Habitat Abundance and Distribution Through Restoration							
Very High	2	3	2	3	1	3	2
High	15	14	15	14	4	14	15
Moderately High	48	56	23	55	38	55	48
Total	65	73	40	72	43	72	65
Maintain Habitat Abundance and Distribution							
Very High	0	0	0	0	44	0	0
High	0	0	0	0	49	0	0
Moderately High	27	21	21	21	51	21	27
Total	27	21	21	21	143	21	27
Reduce Habitat Abundance and Distribution as Result of External Factors							
Very High	7	7	7	7	7	7	7
High	2	2	2	2	2	2	2
Moderately High	0	0	0	0	0	0	0
Total	9	9	9	9	9	9	9
Decline in Habitat Abundance and Distribution as Result of Management							
Very High	0	0	0	0	2	1	0
High	0	0	0	1	1	2	0
Moderately High	0	0	31	2	0	1	0
Total	0	0	31	3	3	4	0
Total for All Management Effect Categories							
Very High	44	45	44	45	54	46	44
High	59	58	59	59	61	60	59
Moderately High	95	97	95	98	90	97	95
Total	198	200	198	202	205	203	198

Table 3-66. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each category of management effect by forest plan revision alternative, Piedmont Districts of the Sumter National Forest.

	Alternative						
Management Effect/Risk	A	B	D	E	F	G	I
Provide Optimal Protection and Management for All Habitat Occurrences							
Very High	5	5	5	5		5	5
High	9	9	9	9	1	9	9
Moderately High	6	6	6	6	1	6	6
Total	20	20	20	20	2	20	20
Improve Habitat Abundance and Distribution Through Restoration							
Very High	0	0	0	0	0	0	0
High	6	12	3	11	1	8	8
Moderately High	5	19	4	16	7	10	14
Total	11	31	7	27	8	18	22
Maintain Habitat Abundance and Distribution							
Very High	0	0	0	0	14	0	0
High	5	0	3	0	12	3	3
Moderately High	14	0	8	2	19	8	5
Total	19	0	11	2	45	11	8
Reduce Habitat Abundance and Distribution as Result of External Factors							
Very High	0	0	0	0	0	0	0
High	0	0	0	0	0	0	0
Moderately High	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Decline in Habitat Abundance and Distribution as Result of Management							
Very High	0	0	0	0	0	0	0
High	0	0	5	1	0	1	0
Moderately High	0	0	7	1	0	1	0
Total	0	0	12	2	0	2	0
Total for All Management Effect Categories							
Very High	5	5	5	5	14	5	5
High	20	21	20	21	14	21	20
Moderately High	25	25	25	25	27	25	25
Total	50	51	50	51	55	51	50

Planning for, and evaluation of, species viability for forest plan revision has focused primarily on providing desired abundance and distribution of habitat elements, in compliance with NFMA regulations. Risks to species viability can be much reduced by additional provisions present in existing law and policy. These include specific consideration of effects to federally listed threatened and endangered species, those

proposed for such listing, and Regional Forester's Sensitive Species, in biological assessments and evaluations conducted as part of all national forest management decisions. These assessments and evaluations identify where additional protective measures are warranted to provide for continued existence of the species on national forest land. Projects that may affect federally listed or proposed species must be coordinated with the US Fish and Wildlife Service. In support of these requirements, these species are also often the focus of inventory and monitoring efforts. Additional species-based provisions included in all forest plan revision alternatives supplement existing law and policy. All alternatives include general and species-specific provisions for federally listed species, developed through coordinated planning with the US Fish and Wildlife Service. Many of the high risk species will be conserved through rare community and riparian prescription requirements included in this Forest Plan, as well as through forestwide objectives related to forest health and community restoration.

Table 3-67. Number of species/habitat relationships rated as of very high, high, and moderately high risk To terrestrial species viability for each category of species status by forest plan revision alternative, Andrew Pickens Ranger District of the Sumter National Forest.

	Alternative						
Species Status/Viability Risk	A	B	D	E	F	G	I
Federally Listed or Proposed as Threatened or Endangered							
Very High	1	1	1	1	1	1	1
High	0	0	0	0	0	0	0
Moderately High	2	2	2	2	3	2	2
Total	3	3	3	3	4	3	3
Regional Forester's Sensitive Species							
Very High	2	2	2	2	3	2	2
High	16	16	16	16	17	17	16
Moderately High	21	21	21	22	20	21	21
Total	39	39	39	40	40	40	39
Locally Rare and Other Species							
Very High	41	42	41	42	50	43	41
High	43	42	43	43	44	43	43
Moderately High	72	74	72	74	67	74	72
Total	156	158	156	159	161	160	156
Total for All Species Status Categories							
Very High	44	45	44	45	54	46	44
High	59	58	59	59	61	60	59
Moderately High	95	97	95	98	90	97	95
Total	198	200	198	202	205	203	198

Table 3-68. Number of species/habitat relationships rated as of very high, high, and moderately high risk to terrestrial species viability for each category of species status by forest plan revision alternative, Piedmont Districts of the Sumter National Forest.

	Alternative						
Species Status/Viability Risk	A	B	D	E	F	G	I
Federally Listed or Proposed as Threatened or Endangered							
Very High	0	0	0	0	1	0	0
High	2	2	2	2	1	2	2
Moderately High	2	2	2	2	2	2	2
Total	4	4	4	4	4	4	4
Regional Forester's Sensitive Species							
Very High	0	0	0	0	2	0	0
High	5	5	5	5	3	5	5
Moderately High	5	5	5	5	7	5	5
Total	10	10	10	10	12	10	10
Locally Rare and Other Species							
Very High	5	5	5	5	11	5	5
High	13	14	13	14	10	14	13
Moderately High	18	18	18	18	18	18	18
Total	36	37	36	37	39	37	36
Total for All Species Status Categories							
Very High	5	5	5	5	14	5	5
High	20	21	20	21	14	21	20
Moderately High	25	25	25	25	27	25	25
Total	50	51	50	51	55	51	50

In conclusion, differences in effects to viability risk among alternatives are relatively small. High- risk species/habitat relationships are primarily a result of historical influences that have reduced distribution and abundance of some habitat elements and species populations, and of future impacts from forest health threats. In general, effects of proposed management strategies are small relative to historical impacts and future external threats. In general, risks to species viability are minimized by forest plan revision alternatives that provide a balanced mix of low-disturbance and disturbance-dependent habitat elements. Some elements in this mix are best provided through passive management and protection, while others require active management for restoration and maintenance.

Slight differences in results presented here from those in the FEIS are primarily the result of updates to species' status information (F Ranks) made during the comment period through review and coordination with NatureServe and their contractors. Additional

changes are the result of adding species inadvertently omitted from the FEIS and, in some cases, adjustments to habitat condition variables based on further analysis and interdisciplinary review. These adjustments have not resulted in substantial changes to overall patterns of risk, or conclusions relative to overall effects of alternatives. It is important to note that information on the status and ecology of this great diversity of species is constantly changing and will continue to do so as the revised forest plan is implemented. Lists of species of viability concern and related information will be maintained and updated as part of plan implementation; however, this updating will typically be small and incremental, and is not expected to change the overall conclusions of this analysis during this planning period.

Aquatic Viability

Affected Environment

Background

Section 219.19 of the NFMA requires that aquatic (fish) habitat be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population is one that has numbers and distribution of reproductive individuals to insure its continued existence and is well distributed in the planning area.

Aquatic habitats are unique in that they are found in and adjacent to streams and lakes. The mobility of aquatic species is usually limited to these habitats. Habitat alteration is probably the major cause of decline of aquatic diversity in the South. Channelization, impoundment, sedimentation, and flow alterations are the most common physical habitat alterations associated with the decline of aquatic species (Walsh et.al. 1995; Etnier 1997; Burkhead et.al. 1997). Other human-induced impacts to aquatic species include pollution, introduced species, and over-harvesting (Miller 1989).

Habitat quality within a freshwater ecosystem is determined by activities within the watershed (Abell et.al. 2000; Scott and Helfman 2002). Therefore, activities in these habitats, or waterbodies, can be described by similar areas of drainage to estimate the amount of suitable habitat. For administrative purposes these watersheds are described 5^{th} level hydrologic units. The planning areas for aquatic species are 5^{th} level hydrologic units or watersheds at the forest plan level.

It is estimated that over 500 aquatic species are found in the 250 watersheds associated with forests in plan revision. It is impossible determine viability for each of these individual species. As a surrogate, the viability of proposed, endangered, threatened and sensitive (PETS) aquatic species are assessed and threat to their viability determined. Other species with wide ranges are generally not at risk.

To determine if there is adequate habitat for these species, the condition of individual watersheds needs to be determined. Watershed condition is determined from the physical and anthropogenic interactions within the watershed. Ideally, watershed condition would be determined from stream surveys. However, the extent and detail required to address all watersheds, including private land, with stream surveys is not available. To address habitat condition at the watershed level it is necessary to determine values from geographic data. These values are compared among the watersheds and a condition or set of conditions is determined.

Methods and Assumptions

Watershed Condition

Hydrologic units or watersheds are defined as areas that drain to a common point. Fifth level watersheds are generally between 40,000 and 250,000 acres. Once these units are digitally determined then they are queried against other geographic information layers. These layers include ownership, streams, roads, point sources, dams, and landuse from the 1970's and 1990's.

These layers were intersected with the 5th level watersheds and determined as a percent of the watershed or as a density (miles per square mile). Table 3-69 shows what layers, their unit, source, and how they are used.

Table 3-69. Layers, use, source, and unit

Layers		Use	Source	Unit
watersheds		planning unit	from NRCS or USFS	5^{th} level HU
ownership		to determine the potential to affect of Forest Service ownership on viability of Species of Concern	from individual forests	percent
streams		used to determine riparian areas	RF3 data from EPA Basins III	not applicable
roads		road density and riparian road density	from tiger census data	miles per square mile
landuse		determine watershed and riparian area landuse	1970 GIRAS data from EPA Basins III, 1994 NLCD from EPA Region 4	percent
dams		determine altered flow	from EPA Basins III	number per square mile
point sources		cerlis, ricris, and npdes sites	from EPA Basins III	number per square mile

This process is modified from the East-wide Assessment Protocol for Forest Plan Amendment, Revision, and Implementation (USDA Forest Service 2000). Instead of a simplified ranking of 1 through n the individual condition factors were valued or graded (one to five) based on natural breaks using the Jenk's optimization formula within ArcView 3.2a. The values for each layer were averaged to calculate a condition score for each metric where 1 –1.5 = impaired, 1.51 – 2.5 = slightly impaired, 2.51 – 3.50 = average, 3.51 – 4.5 = above average, 4.51 – 5 = excellent. This allows for a determination of condition among the watersheds. However, it does not suggest that a watershed with a score of 4 is twice as good as a watershed of 2, only that the watershed with a value of 4 is above average and the watershed with a value of 2 is below average or slightly impaired. A Watershed Health Index (WHI) was developed to characterize the condition (excellent, average, and below average) of 5th level watersheds with respect to current sediment load increases and to determine a range of Forest Service objectives Appendix G).

The combinations of data used determine the metrics that are outlined in the following list:

1) Sedimentation (road density, road density in the riparian, forest cover (1970's and 1990's), and strip mines (average of 1970's and 1990's).
2) Point Source Pollutants (density of point sources).
3) Temperature (road density in the riparian area, and percent forest (1970's and 1990's) in the riparian area).
4) Altered stream flow (density of dams, road density in the riparian, and average density of strip-mines (1970's and 1990's).

Stressors

Each Forest identified the presence of PETS-LR species for each 5th level watershed across the planning area. These databases were combined into a single database and stressors assigned.

Four stressors were identified: sedimentation, point-source pollution, alterations in water temperature, and altered stream flows. Sensitivity to these stressors was assigned for each species, based on the published literature and personal communications (Terwilliger 1991; Etnier and Starnes 1993; Byron Freeman, Wendell Haag, Melvin Warren, Bernard Kuhajda, Stephen Hiner, and Arnold Eversole personal communications). Species sensitivity to the four stressors was compared with the condition of their respective watersheds to determine the threats to their persistence in the planning area. Threats to aquatic species viability are not limited to these four variables; however, GIS coverages are not available for channelization, introduced species, and over-harvest. For forest level planning it is assumed is that these four stressors adequately describe land disturbance activities in the planning area.

Combination of Watershed Condition and Stressors

To identify watersheds at risk the combined values for each of the watershed condition metrics (sediment, point sources, temperature and altered flows) were multiplied against the presence (value of 1) of species of concern with corresponding stressors (Appendix A4). Watershed condition metrics with a score $\geq$ 2.51 (average or above for point sources, temperature and altered flows) and a WHI of excellent (for sediment) are assumed to have sufficient aquatic habitat at the watershed scale to maintain species viability.

Direct, Indirect and Cumulative Effects

Aquatic Viability Outcomes

Species of concern were related to the four environmental factors assessed in watershed analysis (point sources, water temperature, flow, and sediment). Separate viability outcomes were determined for each watershed where a species occurrs, because in many cases watersheds support separate populations, and because factors affecting viability can vary considerably from watershed to watershed. Viability outcomes for each species by watershed were determined by incorporating elements of species distribution, abundance, and sensitivities to environmental factors; watershed condition relative to the species' environmental sensitivities; and the national forest role in the watershed. Possible viability outcomes are:

Outcome 1. Species occurs within watersheds with no impairment. Likelihood of maintaining viability is high.

Outcome 2. Species is potentially at risk in the watershed; however, Forest Service may influence conditions in the watershed to keep it well distributed. Therefore, likelihood of maintaining viability is moderate.

Outcome 3. Species is potentially at risk within the watershed; however, Forest Service opportunity to affect outcomes for the species in the watershed is limited. Therefore species viability in the watershed may be at risk.

Outcome 4. The species is so rare within the watershed (population is at very low density and/or at only a few local sites) that stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Forest Service may influence conditions in the watershed to keep the species relatively secure. Therefore, likelihood of maintaining viability is moderate to low.

Outcome 5. The species is so rare within the watershed (population is at very low density and/or at only a few local sites) that stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Forest Service ability

to influence the species is limited. Therefore species viability in the watershed may be at risk.

Viability outcomes for species on the Sumter National Forest are given in Table 3-70.

Table 3-70. Viability outcome in watersheds on the Sumter National Forest.

		Viability Outcome (Number of Watersheds)					Total
COMMON NAME	**SCIENTIFIC NAME**	**1**	**2**	**3**	**4**	**5**	**Watersheds**
Brook floater	Alasmidonta varicosa		4				4
Oconee stream crayfish	Cambarus chaugaensis		2				2
Carolina darter	Etheostoma collis	1		12			13
Rayed pink fatmucket	Lampsilis splendida			1			1
Carolina heelsplitter	Lasmigona decorata		3				3
Robust redhorse	Moxostoma robustum		3				3
Non PETS Species		3	1	5			9

Non-Native Species

Affected Environment

A multitude of non-native species including non-native plants, insects, and pathogens threaten the integrity of native ecosystems in the southern Appalachian area. These include, but are not limited to, numerous invasive plant species such as kudzu, privet, Japanese honeysuckle, and Nepal grass. The Southern Appalachian Assessment (SAMAB 1996) provides a summary of the major threats from invasive non-native invasive plant pests (pp.121-122). The occurrence of invasive non-native plants continues to increase. Results from FIA plot data, one of the few Regionwide and longer-term inventories in the south, showed that privet (*Ligustrum* sp.) occurrence nearly doubed to 5% between the 1980 and 1990's, and Japanese honeysuckle (*Lonicera japonica*) was prevalent, occupying 20% of the landscape. Kudzu (*Pueraria lobata*), a federally noxious weed first introduced in 1935, today costs farmers and woodlot owners $100 million/annually to control.

On the Sumter National Forest, invasive non-native plant species being tracked through project level inventories, including kudzu, tree of heaven (*Ailanthus altissima*), autumn and Russian olive (*Elaeagnus sp.*), English ivy (*Hedera helix*), sericea lespedeza (*Lespedeza cuneata*), privet, Japanese honeysuckle, Nepal grass (*Microstegium vimineum*), chinaberry (*Melia azerdarach*), multiflora rose (*Rosa multiflora*), Chinese wisteria (*Wisteria sinensis*), and mimosa (*Albizzia julibrissin*). While other invasive plant species may occur with scattered distributions on the forest, these species are recognized as having significant occurrences with a high potential for impacts to native communities on the forest.

Direct and Indirect Effects

In 1999, the Southern Region released a Noxious Weed Management Strategy that outlined five emphasis areas, 1) Prevention and Education, 2) Control, 3) Inventory, Mapping, and Monitoring, 4) Research, and 5) Administration and Planning. This was followed in 2001 with the development of the Regional Forester's Invasive Exotic Plant Species list. A federal executive order issued by President Clinton charges federal landowners to prevent the introduction and spread of invasive species. Forestwide standards which address the control of species on the Regional Forester's invasive non-native plant species list includes the control of non-native species where they are causing adverse effects to rare communities, federally-listed species, or species where viability is a concern, and forestwide standard prohibiting the seeding of invasive non-native species. Forest Plan Goal 14 is to minimize adverse effects from non-native invasive species. Activities in the Revised Plan which result in soil disturbance and increased light availability in proximity to known non-native invasive plant populations, has the potential to increase the potential for spread of these populations. This potential for spread would be highest under Alternatives A, D, F, and I, and lowest under B and G.

Negative effects from non-native species will be less, compared to current management, under all Plan alternatives through the implementation of the above goal and standards.

The National Forest is increasing emphasis on the treatment of invasive species above current management across all alternatives, with highest acres of control predicted under Alternative B, followed by Alternative I. Table 3-71 displays the probable acres of invasive plant control across alternatives.

Table 3-71. Acres of Probable Annual Non-native Invasive Plant Control on the Sumter National Forest, by Alternative

Treatment	Unit	Alt. F (Current)	Alt. A	Alt. B	Alt. D	Alt. F	Alt. G	Alt. I
Invasive plant control	Acres	50	500	1250	500	250	250	750

Cumulative Effects

With an increased emphasis on the management of non-native species in the Southern Appalachian area, particularly plant species, it is expected that the cumulative impacts from invasive non-native species will be reduced across all alternatives, compared to current management. The high rates of growth and expansion of invasive non-native plants, including those on private land ownerships occurring adjacent to the forest, will continue to make control of non-native invasive plants on federal land a large and expensive challenge.

Forest Cover

Affected Environment

Tree species are inventoried as forest stands and classified by forest cover type. A forest stand is defined as a group of trees occupying a specific area. A stand has relatively uniform species composition, age arrangement, and condition so as to be distinguishable from other adjoining areas.

Forest cover type is a classification that identifies the tree species whose crowns dominate a forest stand. Forest cover types with single species tree names do not represent pure stands of that tree species. Up to 30% of a stand may contain other tree species while retaining the single tree species name. Stands that have several tree species with no single species comprising 70% or more of the stand are classified as mixed cover types.

The cover types on the forest can be grouped into general types. Stand ages are equally important to the structure and function of the forest cover as the forest type. General types and age class distributions are shown in Tables 3-71 and 3-72 below. The acreages in the following tables are based on the Continuous Inventory of Stand Conditions (CISC) database, and do not include recent acquisitions such as the Jocassee tract.

Table 3-71. Forest Types and Age-class distribution in the ***piedmont*** *(Enoree and Long Cane Ranger Districts) of the Sumter NF, 2002.*

Forest Type	Age Class (by acres)						
	0-10	11-20	21-40	41-80	81+	Total	%
Loblolly pine*	15,509	39,719	51,127	89,053	5,537	200,945	74
Shortleaf pine	5	0	247	2,325	431	3,008	1
Mixed Hardwood and Pine•	102	442	794	5,398	2,090	8,826	3
Upland Hardwood	59	377	261	19,803	11,407	31,907	12
Bottomland Hardwood	12	631	463	11,904	12,227	25,237	9
Total acres	15,687	41,169	52,892	128,483	31,692	269,923	
% of Total	6	15	20	48	12		

* Includes small acreages of Virginia pine and longleaf pine

• Includes both majority hardwood and majority pine mixed types

*Table 3-72. Forest Types and Age-class distribution in the **mountains** (Andrew Pickens Ranger District) of the Sumter NF, 2002.*

Forest Type	Age Class (by acres)						
	0-10	11-20	21-40	41-80	81+	Total	%
Hardwoods	108	940	863	3,040	15,727	20,678	27
Mixed Hardwood and Pine•	898	78	353	5,704	18,736	25,769	33
Shortleaf pine, pitch pine, Virginia pine	526	2,967	1,100	4,076	7,245	15,914	20
Table mountain pine	0	0	0	46	0	46	0
White pine	75	535	3,527	1,732	2,633	8,502	11
Loblolly pine	0	479	5,802	474	0	6,755	9
Total acres	1,607	4,999	11,645	15,072	44,341	77,644	
% of Total	2	6	15	19	57		

• Includes both majority hardwood and majority pine mixed types

Loblolly pine is the dominant tree species on piedmont uplands. It also occurs in bottomlands, and grows on a wide variety of landforms. Common tree species associated with stands of loblolly pine are sweetgum, oaks, hickories, dogwood, red maple, yellow-poplar, and numerous others.

Bottomland hardwoods are the primary component of floodplains along piedmont creeks and streams. These forest types are commonly mixtures of sweetgum, green ash, sugarberry, river birch, sycamore, cottonwood, red maple, willow oak, water oak, laurel oak, cherrybark oak, swamp chestnut oak, and yellow-poplar.

A large percentage of the upland hardwoods and mixed hardwood and pine stands in the piedmont are on the slopes near smaller streams.

In the mountains, the majority of the forest (57%) is over 80 years of age.

White pine has been increasing over time in the southern Appalachian Mountains.

Acreages of shortleaf pine and pitch pine are declining throughout the southern Appalachian Mountains. Similarly, table mountain pine has declined throughout the southern Appalachian Mountains to the point where it is now considered a rare community.

The Andrew Pickens Ranger District is outside of the native range of loblolly pine. Approximately 6,800 acres of loblolly pine are established there.

Early successional forest (age 0-10) is 5% of the piedmont forested acreage and 2 % of the mountain forested acreage in 2003.

Direct and Indirect Effects

Changes in age class distributions over time are addressed under successional habitats. Effects of the alternatives on extent of table mountain pine are discussed under rare communities.

Over the next several decades, the amount of forest in hardwood types should increase under all of the alternatives considered, given the desired conditions of the management prescriptions. Hardwood cover from most to least should be approximately as follows by alternative:

MOST B G I E A D F **LEAST**

Alternative B has the most restoration (9G2 and 9H) prescriptions. Alternative G has a substantial piedmont area in the 9G2 management prescription, and much or most of the shortleaf pine and pitch pine in the mountains will become hardwood through succession. Over time, however, much of the mountains will also or in turn succeed to white pine. Alternative I has a substantial part of the piedmont in the 9G2 management prescription. The slopes of areas allocated to prescription 9A3 will tend to succeed to hardwood types over time. The desired conditions of 8A1 and 7E2 will also promote more hardwood cover over time. Alternative E will have limited amounts of hardwood types in the extensive allocation of management prescription 8B2. The desired condition in prescription 7E2 will promote more hardwoods, as will succession in prescription 12A and the old growth prescriptions.

The amount of shortleaf pine and pitch pine in the mountains would be relatively static under management prescriptions such as 7E2, 8A1 and 10B. Although the intent of 9H indicates static to increased amounts of shortleaf and pitch pine, the low limits for early successional habitat will reduce the extent of shortleaf and pitch pine for this management prescription.

It will increase under each of the alternatives that convert loblolly pine to more native species, since most of these sites are not mesic. Management prescriptions with low levels of tree harvest would maintain less shortleaf pine and pitch pine in the mountains. Alternatives with more prescribed fire will tend to maintain more of these species. Table 3-73 shows the relative amounts of shortleaf and pitch pine in the mountains by alternative.

Table 3-73. Relative amounts of shortleaf and pitch pine in the mountains by alternative.

MOST	
D	2nd most area in active management allocations. 2nd least area lost due to succession. Has loblolly pine conversions.
I	3rd most area in active management allocations. Next least area lost due to succession.
F	Least area lost to succession, but is the only alternative with no loblolly pine stands converted.
A	Slightly more area than E allocated to prescriptions with active management. Alternative A has about the same amount of prescribed burning in the mountains as Alternative E.
E	
B	Stronger desired condition in 9H management rx, but more old growth allocations add to the amount that will be lost through succession. Limited 1-3% early succession means that much of shortleaf pine and pitch pine in 9H will be lost through succession.
G	Most of the shortleaf pine and pitch pine would be lost to succession over time due to little active management. Would maintain far less of these species than any of the other alternatives.
LEAST	

In the piedmont, Alternative B would restore more shortleaf pine than any other alternative. Alternative I would restore the next most. Alternatives E and G follow I, with both E and G increasing piedmont shortleaf pine about equally. Alternatives A, D and F would not increase the acreage of piedmont shortleaf pine from current levels.

As noted under the affected environment, the amount of eastern white pine has been increasing over time in the southern Appalachian Mountains. Since white pine is shade tolerant, it will tend to increase over time in the absence of harvest. It will also tend to increase over time in the absence of prescribed fire, both because of its shade tolerance, and because young white pine are readily damaged or killed by fire. Table 3-74 shows the relative amounts of white pine by alternative.

Table 3-74. Relative amounts of white pine by alternative.

MOST	
G	Most undisturbed succession.
B	Large 9H restoration prescription has intent to reduce white pine, but low amounts of regeneration permitted will leave much white pine on landscape.
E	
I	More area allocated to active management in the mountains than Alternative E.
A	A, D, and F all have higher harvest levels with 10B allocations. Allows more removal of white pine. Relative ranking of A, D, and F is by area in 10B allocation in the mountains.
D	
F	
LEAST	

The amount of loblolly pine forest cover will decrease under all alternatives, given the desired conditions of the management prescriptions. All of the loblolly pine in the mountains will be converted to more native species under all alternatives except Alternative F. Loblolly pine cover from most to least should be approximately as follows by alternative:

MOST	F	D	A	I	B	**LEAST**
				E	G	

Alternative F would maintain more acreage in loblolly pine forest than any of the other alternatives. It has the largest allocation of management prescription 10B, is the only alternative that does not include management prescription 11 for riparian corridors, and would not convert the loblolly pine forest type in the mountains. Alternatives D, then A have the next largest 10B allocations in the piedmont. Alternatives E and I should have similar amounts of loblolly pine, as would Alternatives B and G.

Stand densities are an important aspect of forest cover. As modeled in SPECTRUM, Alternative B shows a probable activity of approximately 5,000 acres of thinning in the first decade. Alternatives E, F, and I would have approximately 3,000 acres of thinning each. The remaining Alternatives show probable activities of approximately 2,000 acres of thinning each.

According to the desired conditions in management prescriptions, one would expect Alternative G to have the most extensive areas of dense forest, since it has the most extensive allocations of management prescriptions with low levels of timber harvest. Alternative E presents the other extreme, with a large allocation to management prescription 8B2. Most of this area should be in a woodland condition: open park-like stands with very low densities. Once an area is thinned under this prescription, it should remain open for a long period. The extent of this allocation is probably beyond our ability to maintain the desired conditions. Alternative B has a substantial acreage allocated to management prescription 8B2 also, but much less than Alternative E. Because regeneration is very limited in Alternative B, management activity would focus on thinning harvest resulting in substantial amounts of forest with moderate to low stand densities. Alternatives F and I have similar levels of thinning in the Spectrum model. In turn, these are relatively higher than projected acres of thinning for Alternatives A and D, which are similar to each other. As just discussed, relative stand densities from most dense to most open should be approximately as follows by alternative:

DENSE	G	A	F	B	E	**OPEN**
		D	I			

Cumulative Effects

Eastern white pine is gradually increasing in extent through most of the southern Appalachian Mountains. Cumulatively, it is an important trend. Alternatives that take measures to counter this trend are positive in the larger context.

The abundance of shortleaf pine and pitch pine has been decreasing through the southern Appalachian Mountains and the piedmont for many years. Natural succession, southern pine beetle outbreaks and other insects and diseases continue to reduce the numbers of these species. The southern pine beetle outbreaks of 2000 – 2002 killed large acreages of shortleaf pine and pitch pine in the mountains of Tennessee and North Carolina. In this context, maintaining these species takes on more importance. Private land owners in the piedmont region have long discriminated against shortleaf pine because of its relatively slow growth compared to loblolly pine, and because of problems with littleleaf disease. Given the pronounced absence of shortleaf pine on most private lands, the decreasing abundance of these species across all ownerships, and the habitats these species provide, the cumulative effects of managing for these species are important.

The state of South Carolina has more standing hardwood volume than softwood (South Carolina's Forest Resources-----2000 Update, Southern Research Station, Resource Bulletin SRS-65). Extent of hardwood cover does not seem vital in the cumulative sense. However, the (South Carolina) area in oak-pine dropped from 1.9 million acres to 1.4 million acres, and the area in oak-hickory forest type group declined 4%.

Forest Health

Affected Environment

Insect and disease organisms are an important component of forest ecosystems. Native organisms contribute to many ecological processes of forests including nutrient cycling, plant succession, and forest dynamics. In most cases, these native organisms are recognized as an integral component of forest health. In a few instances, however, these organisms cause unacceptable resource damage or loss, and adversely affect ecological, economic, or social values. In these cases, the organisms causing the damage are referred to as pests. Principal native insect pests on the Sumter National Forest include the southern pine beetle and a variety of defoliators. Primary native disease problems include oak decline, annosum root disease, and a variety of other decay organisms affecting living trees.

Throughout the past 100 years, a variety of insects, diseases, and plant species have been introduced to the United States and spread into the Sumter National Forest. These non-native organisms are often pests because they often have no natural enemies or other naturally controlling agent and their unchecked spread can wreak untold damage to native ecosystems and forest communities. Chestnut blight has reduced the American chestnut from the dominant hardwood tree species in the mountains to a minor understory component of today's forests. Other important non-native pests include hemlock woolly adelgid, littleleaf disease, butternut canker, and dogwood anthracnose. Gypsy moth will probably reach the Sumter within the next few decades.

The European gypsy moth (*Lymantria dispar*), is a major defoliator of deciduous hardwood forests. It was first introduced from Europe into Massachusetts in 1869, and because the favored host, oak, is widespread in the eastern deciduous forests, it thrived and continues to expand its range west and south each year. It is established throughout the Northeast, and the infested area extends from New England, south into Virginia and North Carolina, west into Ohio, and includes all of Michigan. As the infested area expands, the frequency of accidental introductions of gypsy moth on the southern Appalachian area national forests will increase. Accidental introductions of gypsy moth may lead to the use of insecticides to eliminate (or eradicate). The continued implementation of the Gypsy Moth Slow the Spread Project (STS) will probably delay the permanent establishment of gypsy moth on the Sumter NF. However, STS will not stop the spread of gypsy moth.

Gypsy moth larvae feed on more than 500 species of trees, shrubs, and vines. Favored hosts include oak, apple, birch, basswood, witch hazel, and willow. Hosts moderately favored by gypsy moth include maple, hickory, beech, black cherry, elm, and sassafras. Least favored hosts include ash, yellow poplar, American sycamore, hemlock, pine, black gum, and black locust. Late instar larvae can feed upon tree species that younger larvae avoid, such as hemlock, maple and pine. Feeding on less favored host plants usually

occurs when high density larval populations defoliate the favored tree species and move to adjacent, less favored species of trees to finish their feeding and development.

Defoliation by the gypsy moth may reduce tree vigor, reduce growth of shoots and stem, cause dieback of the crown, trigger a failure of hard mast production, and sufficiently weaken a tree such that it is attacked and killed by wood boring insects and root decay fungi. Hardwoods in a vigorous condition often can tolerate a year or two of defoliation before canopy dieback becomes pronounced. However, hardwoods that are stressed by drought, oak decline, or some other factor tolerate defoliation less well. The damage caused by gypsy moth feeding in spring is harmful because trees must draw upon reserve carbohydrates and nutrients to produce a second canopy of leaves following defoliation (a process referred to as refoliation). Generally, a tree refoliates when approximately 60% of its canopy is consumed. Production of a new set of leaves following defoliation restores the photosynthetic capability of a tree's canopy, however, the refoliation process draws upon nutrient reserves that would be used for shoot growth and foliage production the following spring. The refoliated canopy is not able to fully replace the nutrients and stored reserves mobilized by the tree during refoliation, leaving the tree in a weaker condition the following spring. As a result, trees exposed to repeated defoliation and refoliation are weaker and more susceptible to attack by wood-boring insects and root-decay fungi.

Once established, gypsy moth population densities fluctuate widely from year to year resulting in episodes of dramatic and severe defoliation followed by periods of relative innocuousness. At low densities, the gypsy moth is regulated, but not eliminated, by natural enemies such as parasitic insects and predaceous vertebrates, particularly small mammals. As populations increase beyond the control of these natural enemies, the gypsy moth is regulated by different mortality factors, primarily diseases and starvation. Of these two factors, diseases caused by the nucleopolyhedrosis virus (gmNPV) and the gypsy moth fungus (*E. maimaiga*) lead to the collapse of outbreak populations of gypsy moth. At the forest stand level, the period between outbreaks may range from 2 to 5 years and the actual outbreak period may range from 1 to 3 years. On a region-wide basis, gypsy moth populations develop to outbreak levels across wide areas of the northeast, mid-Atlantic, and Lake States for a period of years and then drop to very low levels for several years. Factors regulating these regional outbreaks and collapses of gypsy moth populations are not well understood.

The hemlock woolly adelgid, *Adelges tsugae*, an insect species native to Asia, was first identified in the eastern United States in 1924 in Richmond, VA, but it has recently expanded into the Southern Appalachians and threatens to spread throughout the ranges of eastern and Carolina hemlock. It has recently become established along the Chattooga River and the East Fork of the Chattooga. The adelgid may be spread by wind, birds, or mammals (McClure 1990).

Non-native invasive plants known to occur and currently impacting the Sumter National Forest include Japanese and Chinese privet, kudzu, sericea lespedeza, Japanese honeysuckle, wisteria, microstegium, ailanthus, autumn olive, multiflora rose,

Chinaberry, and mimosa. Invasive non-native plant species can spread into and persist in native plant communities and displace native plant species, posing a threat to the integrity of the natural plant communities.

The high percentage of relatively older forest communities in the mountains poses challenges in addressing forest health issues. Approximately 57% of the forested acreage in the mountains is over 80 years of age. These large areas of mature forests are particularly vulnerable to both native and non-native forest pests. Oak decline is a primary concern in mature oak forests. Currently, there are approximately 58,000 acres of upland oak and oak/pine types on the Sumter.

Oak decline is a complex disease involving interactions between environmental and biological stresses and subsequent attacks by secondary pests. The disease generally progresses slowly over several years. It begins with a long-term predisposing stress such as prolonged drought or advanced age. These stressed or older trees are often subsequently damaged by short term inciting factors such as insect defoliation, spring frosts, or acute drought. In their weakened condition, these trees may be attacked by insects and diseases that normally do not invade healthy trees. At this point, classic decline symptoms appear, beginning as dieback from branch tips inward and ultimately resulting in the death of the tree. The most important underlying factor when resource damage is severe may be a tree population dominated by senescent overstory oaks lacking vigor. (Oak, et. al. 1991).

Stand and site factors that determine oak decline risk include forest type (oak density), site productivity (site index), age, and stress factors such as spring defoliation and drought or combinations of these stresses (Oak and Croll 1995). The highest risk conditions are stands with a large oak component (especially red oak of advanced age), growing on sites of average or lower productivity, with a recent defoliation history and prolonged growing season drought. Risk may be reduced by reducing stand age through regeneration harvests, altering species composition through thinning (reduce or eliminate oak component), and/or preventing stress factors (treating spring defoliating insects with insecticides is the only feasible option but is often not economically justifiable).

In the piedmont, the Sumter National Forest has large acreages of loblolly pine that are mature, making them more susceptible to natural senescence, littleleaf disease, and southern pine beetle.

Shortleaf pine is the most seriously damaged host of littleleaf disease, with loblolly pine damaged to a lesser extent. On the Sumter National Forest, littleleaf disease occurs almost exclusively in the piedmont, where shortleaf pine or loblolly pine are growing on eroded clay soils with poor internal drainage. Hardwoods are not affected.

A complex of factors cause littleleaf disease. These include the fungus *Phytophthora cinnamomi*, low soil nitrogen, and poor internal soil drainage. *Phytophthora cinnamomi* is a fungal pathogen of feeder roots. Its development is promoted by poorly drained soils. The first symptoms of littleleaf disease are those of nutrient deficiency; a slight yellowing and shortening of the needles and reduction of shoot growth. In the later

stages of the disease, the symptoms become progressively more distinctive. The crown of an infected tree appears thin and tufted. New needles are discolored and shorten than normal, and the tree loses all but the new needles near the tips of the branches. Branches begin dying, starting in the lower crown and progressing upward through the crown. The disease rarely occurs in young trees, and becomes increasingly severe in older stands. This is one reason that it is often inadvisable to carry piedmont pine stands to advanced ages.

Littleleaf disease is closely tied to past land use. Agricultural use followed by land abandonment and subsequent erosion during the 19th and early 20th century resulted in concentrations of littleleaf disease in southeastern Piedmont of Virginia, North Carolina, South Carolina, Georgia, and Alabama with smaller areas of scattered disease in southeastern Tennessee and Kentucky.

Southern pine beetle (SPB) (*Dendroctonus frontalis*), infestations have occurred cyclically throughout recorded history in the South. SPB outbreaks move from low levels of infestation to high levels over several years. The cycles may be localized or regional and depend upon weather and other stress factors as well as the interrelationship between the populations of SPB and its predators.

The female SPB kills conifers by boring under the bark and destroying the cambium layer of the tree. They construct winding galleries while feeding and laying eggs. During outbreaks, trees are usually mass-attacked by thousands of beetles. The crowns of trees attacked by SPB during warm dry weather may fade in color within weeks. Once a tree is successfully attacked the tree usually turns light greenish-yellow, then yellow, and finally reddish-brown. This color change pattern can vary depending on tree, and environmental conditions.

The Sumter is currently experiencing a southern pine beetle (SPB) epidemic, resulting in substantial mortality to pines. SPB infestations have grown especially fast in dense forests. Higher stand densities make pine stands much more susceptible to SPB attack, and point to the need for maintaining these stands at moderate densities.

Pitch pine, shortleaf pine, and table mountain pine are declining in abundance throughout the southern Appalachian Mountains. This is due to age, southern pine beetle outbreaks, lack of fire, and limited amounts of disturbance.

Fire has historically played an important role in shaping the species composition of the Sumter National Forest. Historically, relatively frequent fires have maintained and restored many forested communities across the piedmont and Southern Appalachians, especially Xeric Pine and Pine-Oak Forest; Dry and Xeric Oak Forests; and Dry and Dry to Mesic Pine-Oak Forests. Without fire or other vegetation management actions that approximate fire effects, many communities may decline dramatically in future years and shift towards shade-tolerant and fire-intolerant species. In the mountains, the absence of somewhat frequent fire has allowed fire dependent table mountain pine to decline to where it is now considered a rare community.

Direct and Indirect Effects

Non-native invasive plants are discussed in a separate section. Table mountain pine is addressed under rare communities. The extent of shortleaf pine and pitch pine are discussed under forest cover.

Southern pine beetle

Risk of attack from southern pine beetle is most directly related to the density of pine stands. It also increases with age. This risk is naturally less as the hardwood component increases. Managers can control density, age, and species composition through vegetation manipulation activities. Thinning and/or regeneration harvest can alter all three of these factors. Thus, the best tool in reducing SPB risk is vegetation manipulation through various types of timber harvest. Those alternatives that regenerate and thin the most acres will most reduce the risk of southern pine beetle attack. Table 3-75 below summarizes the acres of regeneration and thinning harvest outputs resulting from modeling in Spectrum.

Table 3-75. Average annual acres of regeneration and thinning harvest in pine types over the next 50 years.

	Alternative						
Activity	**A**	**B**	**D**	**E**	**F**	**G**	**I**
Acres Regenerated	3,369	1,929	3,266	2,148	3,449	1,683	2,948
Acres Thinned	2,662	4,872	2,573	2,940	3,355	2,103	2,826
TOTAL	6,031	6,801	5,839	5,088	6,804	3,786	5,774

As the table shows, most of the alternatives are somewhat similar in the acres treated, with Alternative G being the notable exception. Alternative E also treats fewer acres than alternatives A, B, D, F, and I, being intermediate between alternative G and these other alternatives. Aside from the anticipated activities produced by the Spectrum model, a number of observations are apparent from the management prescription allocations in the different alternatives.

From these allocations, one would expect Alternative G to present the highest risk from southern pine beetle. It has the most extensive allocations of management prescriptions with low levels of active management. This will allow more forest to become increasingly dense, and leaves a larger acreage of older stands in place.

Alternative E is on the other end of the scale, with a large allocation to management prescription 8B2. Most of this area should be in a woodland condition: open park-like stands with very low densities. The extent of this allocation is probably beyond our ability to maintain the desired conditions.

Alternative B would be at low risk from SPB in the piedmont, but at very high risk in the mountains. It has a substantial acreage allocated to management prescription 8B2, but much less than Alternative E. Over time, its large 9G2 allocation in the piedmont would convert substantial acreages of pine stands to oak-hickory, mixed hardwood-pine and pine-hardwood conditions. In contrast to the piedmont, Alternative B would be at very high risk of SPB problems in the mountains. Management prescription 9H allows for very little regeneration, so most stands would become increasingly old unless natural processes replace them before harvest. The 9H desired condition does not address stand density.

Alternative I has a relatively small 8B2 allocation, but a sizeable 9G2 allocation. Alternatives A, D, and F should result in somewhat similar stand densities and species composition. If their desired conditions are achieved, most stands will be maintained at moderate densities and will not be at substantial risk.

Because insect populations have no regard for property boundaries, the risk in each alternative may affect adjacent property owners as well as the resources on National Forest lands.

Littleleaf disease

As previously stated, littleleaf disease is a concern in the piedmont. It could present a problem on sites where shortleaf pine is reestablished, but this activity should only be undertaken on well drained soils at lower risk from littleleaf disease.

Because loblolly pine and shortleaf pine become more susceptible to littleleaf disease as they mature, late successional stage acres in piedmont pine and pine/hardwood types are the measure used to associate the risk each alternative presents associated with littleleaf disease. This measure is also used because far more of the pine in the piedmont is loblolly pine than shortleaf pine; and loblolly pine is not as susceptible to littleleaf disease at intermediate ages as is shortleaf pine. In piedmont pine and pine/hardwood forest types, the late successional stage equates to age 60 or older. At this time, there are approximately 84,000 acres of pine and pine hardwood types in the piedmont that are this age.

Table 3-76 below displays the piedmont late successional stage acreage in pine or pine/hardwood types 50 years from now, as anticipated by the Spectrum linear programming model.

Table 3-76. Late successional stage acres in piedmont pine or pine/hardwood forest types, 5 decades hence.

Alternative						
A	B	D	E	F	G	I
16,283	76,178	17,951	58,395	3,860	82,784	38,797

Oak decline

As stated previously, oak decline risk factors include forest type (oak density), site productivity (site index), age, and stress factors such as spring defoliation and drought or combinations of these stresses. Of these, managers have no control over site productivity and/or drought and little control over defoliating insects. Attempts to suppress insect pests over the entire, or even a significant part, of the landscape can't be justified economically or environmentally. Thus, species composition (forest type) and age are the factors that managers can manipulate to alter the risk of oak decline. Thinning and/or regeneration harvests can alter species composition and only regeneration harvests can alter the age of a given stand. Thus, the most apparent tool for reducing oak decline risk is vegetation manipulation through various types of timber harvest.

Table 3-77 below displays regeneration and thinning harvest anticipated by the Spectrum linear programming model for upland oak and oak/pine forest types.

Table 3-77. Regeneration and thinning harvest in upland oak and oak/pine forest types over the next 5 decades.

Activity	**Alternative**						
	A	**B**	**D**	**E**	**F**	**G**	**I**
Acres Regenerated	29,169	16,054	33,337	16,704	40,504	2,795	19,948
Acres Thinned	775	6,644	1,071	495	3,075	2,996	1,292
Total	29,944	22,698	34,408	17,199	43,579	5,791	21,240

With the exception of Alternative F, oak decline risk will vary little by alternative in the piedmont. This is because a substantial proportion of the piedmont oak is near streams; and all of the alternatives except Alternative F include riparian corridors. Even under Alternative F, however, the oak and hickory component is to be expanded within management prescription 10B.

As one would expect with their management prescription allocations, Alternative F has the most regeneration, followed by Alternatives D and A. Oak decline risk would be highest for Alternative G, because it regenerates much less oak forest than the other alternatives.

Gypsy moth

Depending on the effectiveness of the Slow the Spread project, the general area infested by gypsy moth will reach the Sumter National Forest within the next 1-4 decades. However, outbreaks may occur on the Sumter from egg masses that are unknowingly imported into the area. This typically occurs when people move from the generally infested area to an uninfested area. Egg masses may be attached to belongings that are kept outside, and go unnoticed. Outbreaks may also occur when egg masses are attached to recreational vehicles that go from the generally infested area to the uninfested area.

Suppression and or eradication of gypsy moth populations would be permissible under all Alternatives. Once the generally infested area reaches the Sumter, the economic cost and concern for environmental impacts of widespread use of current treatment tactics, primarily the aerial application of insecticides, would result in only a very small amount of the forest receiving such management actions. Once the generally infested area reaches South Carolina, gypsy moth outbreaks on most forest lands will not be managed actively and population outbreaks will be brought to an end through the action of natural control agents (primarily by disease epidemics caused by fungal and viral pathogens). The impacts associated with treatments are well documented in the Final Environmental Impact Statement (FEIS) for Gypsy Moth Management in the United States: a Cooperative Approach. This document and associated Record of Decision (ROD) analyzes the impacts of various aerially applied pesticides on control of the gypsy moth, impacts to non-target organisms, as well as impacts to human health. The FEIS and ROD indicate that commonly used the use of suppression, eradication, and slow the spread treatments fully meet the USDA goal of reducing the adverse effects of the gypsy moth, addresses the major issues associated with gypsy moth and their treatment, and provides the greatest amount of flexibility in managing ecosystems affected by the gypsy moth. Means to avoid or minimize adverse non-target impacts due to gypsy moth treatment are discussed in Chapter 2 of the FEIS and have been adopted. The findings from this FEIS are hereby incorporated by reference. It should be noted that such treatments do nothing to alter the risk associated with a vegetative condition. They merely limit the pest.

Once established, gypsy moth impacts will be most significant for stands in the oak and mixed oak-pine forest types. Oaks are a favored host species and a primary indicator of the susceptibility of a stand to gypsy moth defoliation. Gypsy moth outbreaks may tend to be more frequent and the damage more severe in oak stands on parts of the forest where average rainfall is lowest. Gypsy moth outbreaks associated with severe spring droughts may lead to relatively high levels of mortality in affected oak stands (>15% mortality following a single year of severe drought and defoliation; >30% mortality following 2-3 years of severe drought and defoliation). Long-term losses following gypsy moth outbreaks will be more conspicuous on more xeric sites. Outbreaks that cause defoliation for 2-3 years in a row will lead to more severe levels of damage to affected stands and outbreaks that recur in the same stand after very short intervening time intervals will lead to greater levels of damage. Mast production may decline or fail in affected oak stands during and following gypsy moth outbreaks.

Factors that determine gypsy moth risk include forest type (oak density), site productivity (site index), age, and tree vigor. Tree vigor is generally reflected by stand condition (condition class) and age. Managers have no control over site productivity. Thus, species composition (forest type), stand condition, and age are the factors that managers can manipulate to alter the risk of gypsy moth impacts. Thinning and/or regeneration harvests can alter species composition and stand condition while only regeneration harvests can alter age of a given stand. Thus, the best tool in reducing the risk of receiving gypsy moth induced defoliation and/or mortality is vegetation manipulation through various types of timber harvest. Recall that it is unlikely that suppression/eradication efforts could be applied to large areas of the forest due to economic and environmental concerns.

Harvest of these stands in a timely fashion reduces the risk of gypsy moth induced impacts. Harvest can accomplish this goal by removing less vigorous trees during a thinning or other partial harvest. Regeneration harvest also has this effect by reducing stand age, thereby increasing stand vigor and ultimately reducing the vulnerability of the stand to gypsy moth induced mortality in the event of defoliation. The logical conclusion is that those alternatives that harvest more acres in upland oak and mixed oak-pine stands will have a more positive impact on reducing gypsy moth risk. Table 3-78 displays the estimated acres of regeneration and thinning in these forest types by alternative. These acres are based on Spectrum model runs. Note that this table is identical to the table shown in the previous section addressing oak decline. This is because the primary host for gypsy moth is oak, and proxies for tree vigor are the main measure of risk, just as for oak decline.

Table 3-78. Regeneration and thinning harvest in upland oak and oak/pine forest types over the next 5 decades.

Activity	Alternative						
	A	**B**	**D**	**E**	**F**	**G**	**I**
Acres Regenerated	29,169	16,054	33,337	16,704	40,504	2,795	19,948
Acres Thinned	775	6,644	1,071	495	3,075	2,996	1,292
Total	29,944	22,698	34,408	17,199	43,579	5,791	21,240

Hemlock woolly adelgid

Once infested by the adelgid, hemlocks are weakened, gradually lose their foliage, and are unable to refoliate or produce cones. Mortality occurs after complete defoliation, generally within 5 years of initial infestation (McClure 1987). There is no known genetic resistance to adelgids in either of the native Appalachian hemlock species, but resistance is known to occur in hemlocks native to Asia and in the two species native to the Western United States. Individual hemlock trees can be protected by spraying or soil treatments,

but such treatment is impractical for forest trees (Rhea 1996). It appears that all untreated hemlocks, with the possible exception of small geographically isolated populations, could eventually be killed by the adelgid. This impact would occur under all alternatives. Loss of hemlock will negatively impact riparian ecosystems and may result in a substantial decline in habitat quality for birds and other wildlife (Rhea 1996).

If adequate numbers of *Pseudoscymnus tsugae*, a beetle that preys on the adelgid, can be bred and released quickly over the next few years, then hemlock may be saved on the Sumter. Otherwise the outlook is dim. Effectiveness of *Pseudoscymnus tsugae* is uncertain, as are the numbers needed.

<u>In the mountains, outside the natural range of loblolly pine</u>, it is more susceptible to freeze and ice damage, and to pathogens. Converting these stands to more native species and mixed stands should result in healthier, more resilient forests. All alternatives except Alternative F convert all of the mountain loblolly pine stands over the next few decades.

<u>For forest communities adapted to fire</u>, prescribed fire is important to maintaining forest and ecosystem health. In the absence of somewhat frequent fire, natural succession can change the species composition of forests substantially. The largest acreages of prescribed burning are anticipated under Alternatives B and E, approximately 33,000 acres each year. Alternatives A, D, F, and I each look for around 20,000 acres of prescribed burning annually. Alternative G would expect about 10,000 acres of prescribed burning each year.

<u>Cumulative Effects</u>

Southern pine beetle is one of several factors that is having a cumulative effect on the extent of shortleaf pine, pitch pine and table mountain pine in the southern Appalachian Mountains. The direct and indirect effects above should be viewed in that light.

Effects of littleleaf disease are not cumulative with other ownerships. Few other land owners in the piedmont carry loblolly pine stands to the ages common on the Sumter National Forest.

When gypsy moth arrives in South Carolina, the cumulative effects on species of oak, birch and willow will be substantial. Given that there are large acreages of oak forest on private lands, however, the cumulative effect of management actions on the Sumter are not likely to be significant in this context.

Though the effects do not vary by alternative, the cumulative effect of the hemlock woolly adelgid on hemlock populations throughout the eastern United States is ominous. The adelgid infests hemlock regardless of ownership and active management or the lack thereof has no influence on the pest or its impacts on the host. The very sad fact is that hemlocks throughout the Appalachian Mountains are likely to continue to decline and die. The effectiveness of control efforts using the biological control *Pseudoscymnus tsugae* are likely to determine the future of eastern hemlock and Carolina hemlock.

The cumulative effect over time on the health of and reduction in fire adapted/dependent communities has been profound. The section on rare communities and habitats addresses this effect.

OTHER ELEMENTS

Recreation-Related Programs

Developed and Dispersed Recreation

Affected Environment

National forests provide over 191 million acres of public land within the United States. National forests in the Southern Appalachian region contribute approximately 4 million acres to the national total and provide unique settings for a variety of outdoor recreation activities such as primitive and developed camping, hunting, fishing, hiking, backpacking, horseback riding and OHV driving, canoeing/kayaking and whitewater rafting as well as picnicking, sightseeing, nature watching, walking for pleasure, and driving for pleasure.

Market Area

Market areas have been established for different national forests to better evaluate public demand for recreation opportunities. Researchers have defined a market area as all counties that fall within a 75-mile straight-line radius from a forest border. Past research has demonstrated that most national forest visits originate from within a 75-mile (1 ½ hour driving time) radius. (*Oconee and Sumter National Forests Recreation Realignment Report*, Overdevest and Cordell 2001).

The market area for the Sumter National Forest includes the market areas defined for the Oconee National Forest in Georgia. These market areas were combined in recognition of shared local markets and similar geography and demographic patterns. (Cordell 2001) The largest cities within this shared market area include Atlanta, Columbia, Greenville, Charlotte, and Knoxville. Opportunities for outdoor recreation are not limited to the national forests within the shared market area. The Great Smoky Mountains National Park and Blue Ridge Parkway connect and expand opportunities for recreation on federally managed public lands.

The location of the Sumter National Forest across the state of South Carolina makes it readily accessible to people in most of South Carolina as well as several surrounding states such as Georgia, North Carolina, and Tennessee.

The *1989-90 Public Recreation Facility Inventory of South Carolina* identified 1,050,366 acres of recreation facilities and resources within the state of South Carolina. The South Carolina state park system includes 48 state parks on 81,000 acres. The South Carolina Forestry Commission manages three state forests in South Carolina with a total of more

than 65,500 acres: Sand Hills State Forest, Manchester State Forest, and Harbison State Forest. The Department of Natural Resources manages 1.3 million acres of designated wildlife management areas in the state. These lands are a combination of public and private lands, including 364,000 acres of the Sumter National Forest. The South Carolina Department of Natural Resources also manages 43 state heritage preserves throughout the state.

South Carolina contains six national park sites and six national wildlife refuges totaling over 120,000 acres. The U.S.Army Corps of Engineers manages 325,000 acres of land and water along the Savannah River, including three large lake projects: Lake Hartwell, Lake Russell, and Lake Thurmond, all with large recreation areas.

There are many county recreation commissions, some of them offering recreation opportunities similar to those offered on the national forest such as picnicking, as well as more urban activities like basketball, tennis, soccer, and playgrounds.

South Carolina also has a vast amount of private recreation facilities. Because there is not a database available for these sites, they were not considered in depth. The Forest Service typically does not compete with private recreation facilities and often offers different opportunities and experiences. However, on occasion there is some overlap.

Sumter National Forest

South Carolina has over 600,000 acres of national forest, including the 350,000 acres on the Sumter National Forest. The Sumter National Forest consists of three ranger districts: the Enoree, Long Cane, and Andrew Pickens. Each district is unique in its recreation offering as well as its landscape.

- The Enoree Ranger District (161,500 acres) is located in central South Carolina, between Spartanburg and Columbia. The district has a very rural setting with national forest lands interspersed with pasture lands, croplands, industrial timberlands, and small communities. National forest lands in this area are not consolidated and often are adjacent to private lands. The recreation resources include campgrounds and primitive camps, rifle ranges, trails for a variety of uses (including off-highway vehicle use), interpretive opportunities, hunting, and several recreational fishing lakes. The statewide Mountains to the Sea Palmetto Trail will traverse this district when complete. Rose Hill State Park, a historic state park, is located in the middle of the district. An emphasis of this district is a premier network of trails for riding OHVs, horses, and mountain bikes, for hiking, and abundant opportunities for hunting and wildlife viewing.

- The Long Cane Ranger District (117,500 acres) is located on the western edge of the state, bordering Georgia. The district also has a rural setting and an unconsolidated land base. Small towns and communities dot the landscape. Forested lands, pastures, and private residences and industrial timberland coexist. The recreation resources on this district include developed campgrounds, primitive/seasonal camps, rifle ranges, trails for a variety of uses (including off-

highway vehicles), interpretive opportunities, and hunting and fishing opportunities. Several state parks are located within Sumter National Forest boundaries: Baker Creek State Park, Hamilton Branch State Park, and Hickory Knob State Park. Also, there are several Corps of Engineer projects along Strom Thurmond Lake, which borders the district to the west. A state scenic highway (State Highway 28/81) runs through the district and a National Heritage Corridor. An emphasis of this district is a premier network of trails for hiking, for riding OHVs, horses, and mountain bikes, as well as abundant opportunities for hunting and wildlife viewing.

- The Andrew Pickens Ranger District (79,500 acres) is located in the northwest corner of the state, bordering North Carolina and Georgia. The district is also rural in nature. Apple orchards and small residential complexes are common sights. The district's land base is much more consolidated than either the Enoree or Long Cane Ranger Districts. National forest land dominates the landscape with occasional private lands. The recreation resources include developed campgrounds, primitive/seasonal camps, several types of trails, the Chattooga Wild and Scenic River, a rifle range, and hunting and fishing opportunities. Hotspots on this district include the recreation use associated with the Chattooga Wild and Scenic River. The river is a main attraction and people flock to see it. One state park is within the forest boundaries, the Oconee State Park. Another large state park, Devils Fork State Park, is located just a few miles to the east of the forest. This district is located on the state lines for North Carolina, South Carolina, and Georgia and borders both the Chattahoochee National Forest and the Nantahala. These national forests also provide recreation settings and opportunities that affect recreation supply in the area. An emphasis of this district is the world-class Chattooga Wild and Scenic River related experiences and a variety of opportunities for sightseeing and remote experiences.

Recreation Demand and Trends

Recreation demand is a complex relationship between people's desires and preferences, availability of time, price, and availability of facilities. The evaluation of current and future demand for recreation on the Sumter National Forest is based on recent surveys that identify and quantify:

- Estimated number of current recreation visits to the Sumter National Forest.
- Participation rates for recreation activities within the forest market area.
- Future activity demand based on projected population growth and future participation rates.
- Activity demand by demographic strata.

The recent National Visitor Use Monitoring (NVUM) effort by the Forest Service has provided baselines for estimating current use of recreation sites on the Sumter National Forest. These numbers only account for people visiting developed or dispersed sites for

the purpose of engaging in a recreation activity. They do not include the millions of people who simply drive through the national forest.

Table 3-79. Current Recreation Use on Sumter National Forest

Types of Recreation Sites	Current Percentage of Total Estimated National Forest Recreation Visits
Day-Use Developed Sites	17%
Overnight-Use Developed Sites	6%
Wilderness (Dispersed Sites)	1%
General Forest Areas (Dispersed Sites)	76%
Total (679,029 visits estimated)	100%

Based on this NVUM data, developed recreation areas on the Sumter National Forest accommodate approximately 23% of the estimated recreation visits. The remaining 77% of recreation visits can be defined as dispersed recreation that occurs away from developed sites in general forest areas and designated wildernesses.

People within the defined market area for the Sumter National Forest engage in a variety of recreation activities. The following table lists the types of activities offered by the Sumter National Forest. Activities have been ranked in order from highest to lowest participation rates based on the National Survey on Recreation and the Environment (NRSE), an on-going national telephone survey sponsored by USDA Forest Service.

Table 3-80 identifies trends in public demand. Data reflect participation in an activity within the defined market area and not necessarily on the Sumter National Forest.

*Table 3-80. Number of people (**in millions**) over 16 years old participating in recreation activities in Sumter NF market area and percentage increase over next 50 years (Oconee and Sumter National Forest Recreation Realignment Report, Overdevest and Cordell, 200, and from Outdoor Recreation in American Life, A National Assessment of Demand and Supply Trends, H. Ken Cordell, Principal Investigator, 1999)*

Recreation Activity	**2001** Participation Rate	**2000** Number of People	**2010** increase *	**2020** increase *	**2030** increase *	**2040** increase *	**2050** increase *
View/photograph nature or scenery	60%	5.44	15% 6.26	31% 7.13	48% 8.05	66% 9.03	86% 10.12
Driving for pleasure	54%	4.95	15% 5.7	31% 6.48	48% 7.33	66% 8.22	86% 9.21
Picnicking	53%	4.8	11% 5.33	23% 5.90	37% 6.58	53% 7.34	71% 8.21
Visit historic site	50%	4.55	22% 5.55	47% 6.69	77% 8.05	113% 9.69	155% 11.60

Swimming in streams, lakes, e	46%	4.17	6% 4.42	13% 4.71	20% 5.00	29% 5.38	41% 5.88
View wildlife	45%	4.11	15% 4.73	31% 5.38	48% 6.08	66% 6.82	86% 7.64
View natural vegetation, trees	44%	4.05	15% 4.66	31% 5.31	48% 5.99	66% 6.72	86% 7.53
View birds	32%	2.92	15% 3.36	31% 3.83	48% 4.32	66% 4.85	86% 5.43
Visit wilderness or primitive area	32%	2.9	25% 3.63	57% 4.55	96% 5.68	108% 6.03	171% 7.86
Day hiking	29%	2.62	19% 3.12	38% 3.62	59% 4.17	78% 4.66	94% 5.08
Warm water fishing	29%	2.62	9% 2.86	17% 3.07	24% 3.25	26% 3.30	26% 3.30
Motor boating	29%	2.6	1% 2.26	3% 2.68	6% 2.76	11% 2.89	17% 3.04
View/photograp h fish	27%	2.43	15% 2.79	31% 3.18	48% 3.60	66% 4.03	86% 4.52
Developed Camping	21%	1.93	27% 2.45	60% 3.09	98% 3.82	144% 4.71	201% 5.81
Drive off-road	20%	1.76	5% 1.85	10% 1.94	16% 2.04	23% 2.16	34% 2.36
Mountain biking	18%	1.64	12% 1.84	26% 2.07	42% 2.33	61% 2.64	83% 3.00
Primitive camping	16%	1.44	-2% 1.41	0% 1.44	0% 1.44	5% 1.51	0% 1.44
Coldwater fishing	14%	1.28	9% 1.40	17% 1.50	24% 1.59	26% 1.61	26% 1.61
Rafting	12%	1.06	5% 1.11	9% 1.16	16% 1.23	30% 1.38	51% 1.60
Backpacking	11%	0.99	23% 1.22	57% 1.55	96% 1.94	108% 2.06	171% 2.68
Big Game Hunting	10%	0.89	97% 1.75	93% 1.72	89% 1.68	83% 1.63	76% 1.57
Small-game Hunting	9%	0.82	97% 1.62	93% 1.58	89% 1.55	83% 1.50	76% 1.44
Horseback riding on trails	8.3%	0.76	9% .83	19% .90	27% .97	30% .99	31% 1.00
Canoeing	8%	0.73	5% .77	9% .80	16% .85	30% .95	31% .96
Kayaking	3%	0.23	5% .24	9% .25	16% .27	30% .30	31% .30
Migratory bird hunting	2%	0.17	97% .33	93% .33	89% .32	83% .31	76% .30

**Data increase show change from 2001*

Demographic information collected within the market area also revealed trends affecting recreation demand. Developed camping and swimming emerged as the most favored activities across the surveyed demographic groups. (*Oconee and Sumter National Forest Recreation Realignment Report*, Overdevest and Cordell 2001)

Another component of demand is the breakdown of the recreation activities across seven demographic categories. Below is a summary of the information presented in the *Oconee and Sumter National Forests Recreation Realignment Report* (Overdevest and Cordell, 2001):

- Age Category – Age affects the recreation activities in which a person participates. Currently, only the 35 to 44 age strata preferred day-use activity. Developed camping is one of this age group's favored activities.
- Gender – Gender is highly important in determining which activities people chose. However, neither male nor female listed day-use activities as a favorite. Hunting is a favorite among men and viewing birds and wildlife is a favorite among women.
- Household Size – The number of family members affects the activities they choose. For households of four or more, developed camping is a favorite. Swimming is a favorite for households of four. No other households mentioned day-use activities as a favorite.
- Race and Ethnicity – Shifting racial and cultural ethnicity is not pronounced in this area, but still a consideration. Asian Americans/American Indians list developed camping as one of their favorites.
- Income – Income is very much linked to recreation participation choices. Favorite day-use activities are developed camping for the $40,000-$49,000 income strata and swimming for the $50,000-$74,000 income strata.
- Urban and Rural – Urban populations are growing at a much faster rate than rural populations. Demand for urban population preferences would increase at higher rates. Urban population favorites include swimming and developed camping.
- Disability – A person's outdoor recreation activities are highly defined by disability status. Swimming is a favorite among people with physical disabilities.

The day-use activities most favored by more demographic groups are developed camping and swimming.

Recreation Opportunity Spectrum

Recreation Supply: For planning purposes, recreation supply is defined as the opportunity to participate in a desired recreation activity in a preferred setting to realize desired and expected experiences. Three components of supply are settings, activities, and facilities. (SAA, p.140) Recreationists choose a setting and activity to create a desired experience.

The USDA Forest Service manages a supply of settings and facilities.

The recreation opportunity spectrum (ROS) is a planning tool used to identify and evaluate recreation settings on the Sumter National Forest (Table 3-81). The entire national forest has been classified in five ROS classes: primitive (P), semi-primitive non-motorized (SPNM), roaded natural (RN1), and rural (R).

- Primitive (P) is the most remote, undeveloped recreation setting on the forest. These settings are generally located at least three miles from any open road and are 5,000 acres in size or larger. The primitive ROS class is limited to areas managed under the Wilderness Act on the Sumter National Forest. With few exceptions, the Wilderness Act prohibits the use of mechanized equipment for recreational use, personal rescue, resource protection, or trail construction and maintenance. Groups of visitors are often limited to a specific size to retain a sense of isolation and solitude.

- Semi-primitive non-motorized (SPNM) areas are less remote and can be as small as 2,500 acres and only a half-mile or more from any open road. These settings accommodate dispersed non-motorized recreation.

- Semi-primitive motorized (SPM) areas are less remote and can be as small as 2,500 acres and only a half-mile or greater from any open road. These settings accommodate dispersed motorized recreation.

- Roaded natural (RN) settings are located within a half-mile of a road and usually provide higher levels of development such as campgrounds, picnic areas, and river access points.

- Rural settings represent the most developed sites and modified natural settings on the forest.

Table 3-81. Current Distribution of ROS Classes on the Sumter National Forest

Recreation Opportunity Spectrum (ROS) Classes	National Forest Lands	Current Inventory* (Acres)
Wilderness/Primitive (P)	1%	4,800
Semi-Primitive Non-Motorized (SPNM)	2%	6,000
Semi-Primitive Motorized (SPM)	0%	150
Roaded Natural (RN)	97%	353,150
Rural (R)	<1%	600
Total	100%	364,700

**This is based on the following: wilderness includes the designated and recommended wilderness areas, semi-primitive non-motorized acres includes inventoried roadless areas, and the rural acres include the developed recreation sites/areas.*

The Southern Appalachian Assessment Social, Cultural, Economic Technical Report (SAA) states that in the Southern Appalachian region, approximately 45% of the region is in rural settings, 24% in roaded natural, 18% in urban, suburban, or transitional settings, 8% in primitive or semi-primitive. This indicates that primitive and semi-primitive are in shorter supply than the rural or roaded natural settings.

Developed Recreation

A developed site is a discrete place containing a concentration of facilities and services used to provide recreation opportunities to the public and evidencing a significant investment in facilities and management under the direction of an administration unit in the National Forest System. Recreation sites are developed within different outdoor settings to facilitate desired recreational use. Developed recreation sites include such facilities as campgrounds, picnic areas, shooting ranges, swimming beaches, and historic sites.

Developed recreation sites provide different levels of user comfort and convenience based on the assigned ROS setting. Development Levels range from 1 to 5, with 1evel 1 representing the most primitive, natural settings with minimal or no site amenities. Level 5 represents the highest level of development with fully accessible facilities.

General descriptions of development levels are described as:

- Development Level 1 – Minimum site modifications, rustic or rudimentary improvements designed for the protection of the site rather than comfort of the users. Generally not found in developed recreation sites.
- Development Level 2 – Minor site modification, mostly rustic materials, primitive motorized access. An example of a development level 2 site is Key Bridge Seasonal Camp.
- Development Level 3 – Moderate site modification for comfort of users as well as protection of the site, synthetic materials used, roads may be paved and trails formalized. Examples of development level 3 sites include Sloan Bridge Picnic Area and Indian Creek Shooting Range.
- Development Level 4 – Heavy site modification, many amenities for public convenience, synthetic materials common, motorized access by high standard roads. Examples of development level 4 sites include Whetstone Campground and Parson's Mountain Campground.
- Development Level 5 – High degree of site modification, many amenities and some luxury for public convenience, landscape may contain non-native plants, formal paved walkways in addition to highway access. The Sumter National Forest doesn't have development level 5 sites.

<u>Supply of Developed Recreation Sites</u>: The Forest Service defines the capacity of developed recreation sites in terms of "people at one time" a site can support (PAOT). Forty-three developed sites are currently managed by the Sumter National Forest to accommodate different recreation activities. Tables 3-82 and 3-83 illustrate the different types of facilities provided across the forest and their current capacity in PAOT. See Appendix B for a description of the NVUM process and discussion of recreation visits by alternatives over time.

The following tables display the existing PAOT by development level and by site type. This helps describe the existing capacity the forest has at its recreation sites. (Table 3-82

does not include the PAOT for trailheads and for boat launches. They are better indicators for dispersed recreation and will be discussed in that section. It does include PAOT from developed camping, picnicking, swimming, rifle ranges, and interpretive sites.)

Table 3-82. Current Capacity of Day-Use Developed Sites (DUDs)

Type of Day Use Developed Site	Total Number of Sites	Total Capacity (PAOT)
Picnic areas	11	695
Beaches & swimming areas	2	150
Shooting ranges	7	115
Parking areas, overlooks, and historical sites	3	417
Total Day-Use Capacity	23	1,377

Table 3-83. Current Capacity of Overnight-Use Developed Sites (OUDs)

Type of Day Use Developed Site	Total Number of Sites	Total Capacity (PAOT)
Level 1 Campgrounds	0	0
Level 2 Campgrounds	4	490
Level 3 Campgrounds	14	1,625
Level 4 Campgrounds	2	215
Total Overnight Capacity	20	2,330

Hotspots for developed sites on the Sumter National Forest are minimal.

Dispersed Recreation (Motorized and Non-motorized Use)

Dispersed recreation is defined as those activities that occur outside of developed recreation sites such as boating, fishing, hiking, and biking. There are 20 developed recreation sites that facilitate dispersed use of the forest with amenities such as trailheads and boat ramps. (Tables 3-84, 3-85, 3-86, and 3-87)

Table 3-84. Developed Access Points for Dispersed Recreation

Type of Developed Site	Existing Number of Sites	Existing Capacity (PAOT)
Trailheads	9	375
River Access Points	14	430
Lake Boat Ramps	7	225
Fishing Sites	5	N/A
Total	35	1,030

Table 3-85. Miles of Non-Motorized Trails on Sumter National Forest

Type(s) of Non-Motorized Use Allowed	Existing Miles of Designated Trails
Hike only	72
Hike and Mountain. Bike only	24
Hike and Equestrian only	21
Hike, Mountain Bike, and Horse only	57
Paddle Sport	125
Total	299

Table 3-86. Miles of Motorized Trails

Type(s) of Motorized Use Allowed (mountain bikes and hiking also allowed)	Existing Miles of Designated Trails
Motorcycle/OHV only	46.0
Total	46.0

Table 3-87. Acres of Current Wildlife/Game Habitat Emphasis Areas

Type of Fish & Wildlife Habitat Emphasis	Unit of Measure
Woodland/Savanna Habitat	3,000 acres
Permanent Openings	12,900 acres
Early Successional Forest Habitat	42,400 acres
Stocked (Put & Take) Streams	67.8 Miles of Streams
Stocked (Put & Take) Reservoirs	13,600 Acres

**Woodland/Savanna habitat includes the prescription 8B2. Permanent openings include habitat associated with closed roads, traditional wildlife openings and linear strips such as ROWs and utility corridors. Early Successional forest habitat includes Prescription Areas 7E2, 8A1, 9G and 10B.*

The hotspots of dispersed recreation on the Sumter include the high weekend use of the OHV trailheads and trail systems on the piedmont districts.

Direct and Indirect Effects

Existing recreation demand is expected to grow for a variety of activities including dispersed and developed recreation (see Table 3-80). Existing use on the national forest will increase as recreation demand and populations grow over the next 10 years. No changes to existing wilderness designation (1A).

General themes were developed for Alternatives A, B, D, E, G, and I that emphasize different resource management objectives. Alternative F is the current management alternative and will provide the baseline for evaluating other alternatives. Each alternative theme and its allocation of prescription areas provide the parameters for redefining the current distribution of the recreation opportunity spectrum, as well as facility scale and development. Road management direction and the emphasis placed on recreational use, either dispersed or developed, were major factors in determining the effects of each alternative to recreation.

National forest management could affect recreation by constructing or removing recreation facilities and improvements; changing development levels; restricting, prohibiting, or encouraging use; altering the land to make it suitable or unsuitable for use; and changing the landscape setting. Evaluation of potential recreation effects requires that these elements be considered: activities, setting, and experiences.

Refer to other sections of the FEIS for additional recreation environmental consequences related to Scenery, Wild and Scenic Rivers, Wilderness, Roadless Areas, and Special Areas.

Recreation Opportunity Spectrum

Table 3-88 displays the estimated distribution of acres of ROS classes by alternative.

Table 3-88. Estimated Distributions of ROS Classes by Alternative

ROS Class	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F*	Alt. G	Alt. I
Primitive (P)	10,493	9,923	4,961	7,938	5,136	9,148	4,837
Semi-Primitive Non-Motorized (SPNM)	4,462	5,011	5,872	7,036	3,275	37,940	3,290
Semi-Primitive Motorized (SPM)	16,669	8,992	6,227	41,416	161	202	5,153
Roaded Natural (RN)	328,865	336,563	343,429	304,099	351,917	313,199	347,209
Rural (R)	600	600	600	600	600	600	600
Not Inventoried (water, etc.)	1,761	1,761	1,761	1,761	1,761	1,761	1,761
Total	362,850	362,850	362,850	362,850	362,850	362,850	362,850

**Based on the prescriptions, not on existing inventory.*

***Areas designated (recommended) as wilderness are managed for primitive (P) recreation opportunity.*

All alternatives contain a variety of recreation opportunity spectrum settings from the most primitive to more developed. However, the emphasis in some alternatives is to provide recreation opportunities in settings that are more remote and less developed, such as semi-primitive non-motorized. The acres of primitive, semi-primitive or more remote settings are greatest in Alternatives E and G. Effects of this change in settings will be positive for those visitors seeking a more remote experience and less positive for those visitors who prefer a more developed experience. The acres of semi-primitive or more remote settings are the least in Alternatives D, F, and I. Alternatives A and B all have moderate increases in remote settings and opportunities. Acres for more developed settings are greatest in Alternatives D, F, and I. Acres for more developed settings are moderate in Alternatives A, B, and G. Acres for more developed settings are least in Alternative E.

Increasing remote settings may be associated with road closures in some areas, both seasonal and permanent. The effects of road closure decrease access by motorized vehicles. Closing roads increases the satisfaction of visitors who prefer solitude and fewer disturbances (such as dust and noise) by motorized vehicles. Road closure often reduces wildlife poaching and littering.

Developed Recreation

Table 3-89 shows that Alternatives B, D, F, G and I and have little to no change in the amount and capacity, or development level of developed recreation sites on the forest, but do emphasize changes to upgrade the accessibility of existing sites, which are considered high priority improvements.

Table 3-89. Estimated Increase in Capacity of Developed Recreation Areas by Alternative (PAOTs)

Type of Development	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F*	Alt. G	Alt. I
Day-Use Areas	Low	Low	Low	Low	Low	Low	Low
Level 2 Campgrounds	Low	Low	Low	Low	Low	Low	Low
Level 3 Campgrounds	Decrease	Low	Low	Decrease	Low	Low	Low
Level 4 Campgrounds	High	Low	Low	High	Low	Low	Low

**Baseline = Alternative F, Existing Developed Recreation PAOTs (Tables 3-82 & 3-83)*

Low Increase = < 5% increase in existing PAOTs

Moderate Increase = 6-25% increase in existing PAOTs

High Increase = > 26% increase in existing PAOTs

Decrease = any decrease in existing PAOTs

PAOTs increase in Alternatives A and E. Effects include a greater satisfaction for users of all abilities as more sites become accessible. However, with limited capacity increase, some sites that will be increasingly overused and crowded at peak times, such as holidays

and weekends, may lower satisfaction for some visitors. Use will reach capacity more often over time and some visitors will have unmet expectations.

Some activities/actions will affect developed recreation and effects will depend on the proximity and magnitude of the activity. These activities include construction, reconstruction and maintenance of roads and trails, vegetation management (including thinning, conversion, regeneration, insect and disease control, prescribed burning and pesticide use), and mineral exploration. Some activities, such as prescribed burning or pesticide use, have short-term effects that decrease for a short time the satisfaction of visitors in the area. Other activities such as road construction or insect and disease control may influence satisfaction on a long-term basis. Other natural causes such as wildfires or tornadoes can greatly affect developed recreation areas long-term or permanently.

The allocation of lands to wilderness will affect all mechanical and motorized transport forms of recreation, such as mountain bike riding, according to the Wilderness Act of 1964. Also, with additional designations of wild and scenic rivers, increased public interest would result in more river use for canoeing, camping, and fishing. Opportunities for fishing and hunting may be reduced.

Hotspots of developed recreation are sites that are consistently at or over their design capacity on certain weekends and holidays. Hotspots of use for developed recreation will continue to be more and more crowded over time as use continues at these popular places. Upgrades of facilities, visitor use controls, and implementation of fees often help control use and overuse at these sites.

Dispersed Recreation

Table 3-90 displays the estimated increase in non-motorized trails by alternative. Table 3-91 displays the designated OHV areas by alternative. Table 3-92 displays the estimated change in motorized trails by alternative.

Table 3-90. Estimated Increase in Non-Motorized Trails by Alternative

Type of Trail	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F*	Alt. G	Alt. I
Hike only	Low	Low	Low	Low	Low	Low	Low
Hike and Bike only	High	Low	Low	High	Low	Low	High
Hike and Equestrian only	Low	Low	Low	Low	Low	Low	Low
Hike, Bike and Equestrian only	Moderate	Low	Low	Moderate	Low	Low	Moderate
Paddle sports	Low	Low	Low	Moderate	Low	Low	Low

Baseline = Alternative F, Existing Miles of Trail

Low increase = < 5% increase of existing miles of non-motorized trail (0 to 15 miles)

Moderate increase = 6-25% increase of existing miles of non-motorized trail (16 to 75 miles)

High increase = > 26% increase of existing miles of non-motorized trail (over 75 miles)

Decrease = any net loss of existing trail

Table 3-91. Designated OHV Areas (in acres) by Alternative

Type of Motorized Use	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F*	Alt. G	Alt. I
7C Designated OHV Area	3,500	0	0	3,500	0	0	0

Table 3-92. Estimated Change in Motorized Trails by Alternative

Type(s) of Motorized Use Allowed	ALT A	ALT B	ALT D	ALT E	ALT F	ALT G	ALT I
Motorcycle/ATV and Mountain Bike	High	Low	Low	High	Low	Low	High

Baseline = Alternative F, Existing Miles of Motorized Trail

Low increase = < 25% increase of existing miles of trail (0-12 miles)

Moderate increase = 11-50% increase of existing miles of trail (13 to 25 miles)

High increase = > 50% increase of existing miles of trail (over 25 miles)

Alternatives A and E increase most trail systems due to the emphasis of those alternatives on recreation. Increases include hiking, mountain biking, horseback riding, and motorized OHV trails. Some users may experience user conflicts on increased trails. Those alternatives that increase the trail system will reduce some of the unauthorized off-trail use. Increases in the trail system will also have effects of more litter, safety concerns, law enforcement needs. Alternatives B, D, E, F, and G keep the current trails system. This can lead to resource impacts if there is significant unmet demand for that particular activity.

There are no planned increases in hiking-only trails in any alternative. This can lead to overuse and resource impacts if there is substantial unmet demand for trails that allow only hiking. There are several alternatives where hiking is combined with mountain biking and equestrian trails that will meet some of the demand for increased hiking opportunities. Tables 3-90, 3-91, and 3-92 display the allocation by alternative to trails.

Increases in equestrian trail opportunities will increase the recreation experiences of recreationists who enjoy that sport; additional trails add to their experience variety, flexibility, and access to different parts of the forest. The greatest increases in equestrian trails occur in Alternatives A, E, and I. Alternatives B, D, G, and F do not propose any new equestrian trails. This can lead to overuse and resource impacts if there is substantial unmet demand. Also, equestrian trails are often multiple use, allowing hiking and mountain biking on the same trails. Occasionally, this can lead to user conflicts. Tables 3-90, 3-91, and 3-92 display the allocation by alternative to trails. Cross-country equestrian trail use is allowed in Alternatives A, D, F, G and I; effects of this activity include resource impacts when a user-created trail develops. The satisfaction of some horseback users is greater if horseback riders are allowed off-trail where there is a sense of freedom. However, other forest visitors' satisfaction is decreased when resource impacts from these cross-country horse users affect their experience. In Alternatives B and E, equestrian use is not allowed off-trail. The effects of this activity include fewer resource impacts because fewer user-created trail develop. It is easier to enforce rules and regulations relating to not damaging the resources. Most forest visitors' satisfaction is increased when resource impacts from these cross-country horse users are minimized.

Increases in OHV trail riding opportunities will increase noise disturbance and may lessen the recreation experience of other recreation participants such as hikers, hunters, fishermen, campers, and those seeking solitude. Increases in OHV trail riding opportunity will improve the recreation experiences of recreationists who enjoy that sport; additional trails add to their experience variety, flexibility, and access to different parts of the forest. Tables 3-90, 3-91 and 3-92 display the allocation by alternative to trails.

Increases in mountain bike opportunities will increase the recreation experiences of recreationists who enjoy that sport; additional trails add to their experience variety, flexibility, and access to different parts of the forest. The greatest increases in mountain bike trails occur in Alternatives A, E, and I. Alternatives B, D, G, and F do not propose any new mountain biking trails. This can lead to overuse and resource impacts if there is substantial unmet demand. Also, mountain bike trails are often multiple use, allowing hiking and equestrian use on the same trails. Occasionally, this can lead to user conflicts. Tables 3-90, 3-91, and 3-92 display the allocation by alternative to trails.

Increases in interpretive trails (which are usually on existing hiking trails) enhance experiences for most visitors. Also, by sharing information about ecosystems, history, and resource management through interpretation, better-informed visitors often result in good partners in management.

Alternatives A, E, and I increase dispersed recreation access points, such as boat ramps and trailheads, the greatest. Increases in dispersed recreation access points may include greater user satisfaction for some users, higher use for trails, and easier access to different parts of the forest for some users.

Alternatives that allocate additional acres to big and small game emphasis areas will increase the hunting and wildlife viewing experiences. Table 3-93 displays the allocation by acres by alternative to these areas.

Table 3-93. Estimated Total Acres (Total for 1st Decade) of Wildlife Emphasis by Alternative

Type of Game Habitat*	ALT A	ALT B	ALT D	ALT E	ALT F	ALT G	ALT I
Woodland/Savanna Habitat	7,200	13,700	6,800	22,700	2,800	3,700	7,400
Permanent Openings	6,300	5,500	7,300	8,100	9,100	5,400	6,800
Early Successional Forest Habitat	39,000	16,100	35,100	23,400	45,000	16,100	31,900
Total	**52,500**	**35,300**	**49,200**	**54,200**	**56,900**	**25,200**	**46,100**

**Woodland/Savanna habitat includes the prescription 8B2. Permanent openings include habitat associated with closed roads, traditional wildlife openings and linear strips such as ROW's and utility corridors. Early Successional forest habitat includes Prescription Areas 7E2, 8A1, 9G and 10B.*

Some alternatives emphasize hunting, fishing, and non-consumptive wildlife opportunities more than others. Effects of this emphasis will include increased opportunities for hunting, fishing, and non-consumptive wildlife viewing on some parts of the forest. Alternatives F, D, E, A, and I had the largest amount of acreage in those habitats. Acres of habitat management for big and small game hunting are least in Alternative G; Alternative B is in between. Increases in hunting habitat will increase the user satisfaction for visitors in some areas. Effects on hunters, both small and big game, will generally be positive. Some specific areas on the forest will not be managed for game species that were in the past; this will affect hunters more negatively by decreasing the places or the success ratio. Some areas will be managed differently than in the past and hunter satisfaction may increase in those areas. Hunting decreases the satisfaction of some other users, especially some trail users, due to safety concerns. To avoid safety concerns, effects may include a decrease in use on certain trails during the hunting season. Hunting is not allowed on Sundays during the hunting season; use in the general forest area, including trails, may be higher during those days

The quantity of stocked (put and take) streams and reservoirs are not expected to change over alternatives. Some areas may become more accessible based on increased access

from trails and roads in Alternatives A, E, and I; in Alternatives B and G, access may be decreased.

Wilderness and Roadless Areas

Affected Environment

Wilderness

Congressionally designated wildernesses are protected by law and valued for their ecological, historical, scientific, and experiential resources.

Currently on the Sumter National Forest, there is one designated wilderness (Table 3-94). Ellicott Rock Wilderness is shared among three national forests – the Sumter, the Nantahala, and the Chattahoochee. The combined acreage for the entire wilderness area is 8,271 acres. Ellicott Rock Wilderness has 2,856 acres on the Sumter. On the Sumter National Forest, this represents less that 1 percent of the total forest acreage. The existing wilderness area will be managed to maintain the area's natural characteristics. Natural occurrences such as outbreaks of insects or disease are allowed as part of the natural cycle. Human-caused intrusions are not allowed. Under emergency conditions, mechanical equipment and motorized transport may be approved for use to control fire which threatens life, property, or the wilderness resource. The Sumter National Forest contains one recommended wilderness study area that has not been acted upon by Congress – Ellicott Rock Extension (1,982 acres.) Areas that are designated as wilderness are managed for a primitive recreation opportunity.

Annual use in Ellicott Rock (the South Carolina portion only) is about 11,590 visits per year, or about 1% of total visitor use on the forest.

Table 3-94. Existing Designated Wilderness Areas

Name	Acres	Designated Wilderness Area	Recommended Wilderness Area
Ellicott Rock	2,856	Yes	NA
Ellicott Rock Extension	1,982	NA	Yes

Roadless

The first step in the evaluation of potential wilderness is to identify and inventory all roadless, undeveloped areas that satisfy the definition of wilderness found in Section 2 (c) of the 1964 Wilderness Act (FSH 1909.12, Chapter 7, Item 7.1). Roadless areas are places that have retained or are regaining a natural, untrammeled appearance; any signs of prior human activity are disappearing or being muted by natural forces. One criteria

provides for an individual roadless area to include no more than one-half mile of improved road for each 1,000 acres.

In the forest planning process, national forests are required to assess roadless areas (Chapter 7 of FSH 1909.12). A new roadless inventory was conducted as part of the Southern Appalachian Assessment, with additional guidelines developed by the SAA team and Forest Service Region 8/Atlanta, to facilitate consistent application of the process.

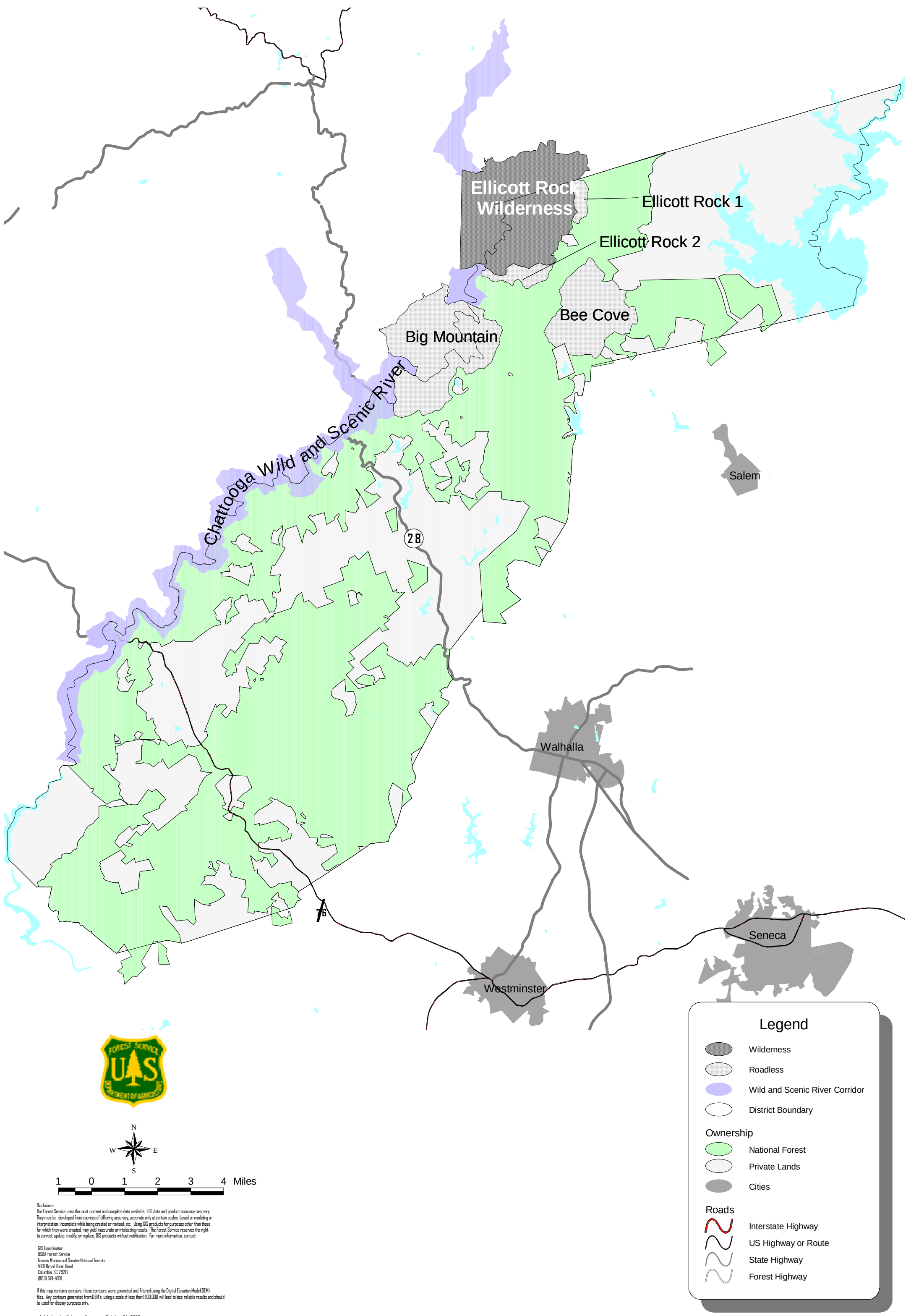
Through that process, the Sumter National Forest currently has four inventoried roadless areas totaling approximately 6,161 acres that could be recommended for wilderness study (Table 3-95). One of the areas is shared with the Chattahoochee National Forest.

*Table 3-95. Roadless areas and approximate acreages**

Roadless Area	Acres
Bee Cove	2,999
Big Mountain (SC portion only)	2,332
Ellicott Rock I	300
Ellicott Rock II	530
Total	6,161

**Source: The South Appalachian Assessment, Social/Economic Report*

Wilderness, Roadless Areas
and Wild and Scenic Rivers
Andrew Pickens Ranger District
Sumter National Forest



For each roadless area, a report was prepared that evaluates its wilderness potential. These reports are found in Appendix C and are in accord with 36 CFR 219.17. The evaluation reports consider wilderness potential in three main categories: capability – the qualities that make a roadless area suitable or not suitable for wilderness; availability – an assessment of the non-wilderness resources and demand of the area; and need – a consideration of the amount of wilderness already in the area and region.

Outdoor recreation is one of the benefactors of wilderness and is one of the drivers of wilderness demand and wilderness management. According to trend data collected from 1965 to 1994, the trend in recreation visits to national forest wilderness has paralleled designations and increased over time. In the southeast, participation rates and trends in wilderness indicate a continued increase in visitation to wilderness with an estimated 7,860,000 visits to wilderness by the year 2050 (see Table 3-80 in Developed and Dispersed Recreation).

It is important to understand when analyzing wilderness and roadless allocations, that in addition to outdoor recreation in wilderness, there is a non-user component that values American wilderness. Wilderness is valued for preserving representative natural ecosystems and local landscapes. The very existence of wilderness is valued by the American public as part of the natural heritage of the country. The *National Survey on Recreation and the Environment*, 2000, found that 69.8% 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% agreed or strongly agreed with the statement, " I enjoy knowing that future generations will be able to visit and experience wilderness areas."

<u>Direct and Indirect Effects</u>

Wilderness

Wilderness has many positive effects. As stated above, wilderness preserves natural systems and provides places of solitude for visitors. However, there are environmental effects within wilderness from many sources. Recreational use can have negative impacts to the quality, character, and integrity of the wilderness resource due to overuse. Some of these negative impacts include soil compaction; vegetation loss, disturbance and/or replacement by non-native species such as noxious weeds on trails and campsites caused by heavy recreation use; crowding and loss of solitude; deterioration of water quality from improper disposal of human waste and waste water; and loss of or threats to biological/ecological processes and biodiversity, through human disturbance.

Other environmental effects which impact the integrity of the natural systems in wilderness include air pollution from outside sources, interruption of natural functioning ecosystems by fire suppression, and threats to native plant species from the spread of noxious weeds from sources outside wilderness.

No significant new management direction is being proposed for existing designated wildernesses on the forest under any of the alternatives, so there are no significant direct, indirect, or cumulative effects to the existing wilderness resource. Expansion to existing wilderness is proposed by allocating adjacent lands to wilderness study areas; for discussion of effects, see the Roadless section that follows.

Roadless

Both the decision to designate wilderness study areas and the decision not to designate wilderness study areas have environmental consequences. The magnitude of the effects varies by alternative depending upon the number of roadless areas assigned.

Three categories are used to summarize how each roadless area is allocated in the alternatives. These categories are: recommended wilderness study (W), roadless areas maintaining roadless characteristics (R), and roadless areas not maintaining roadless characteristics (N). Table 3-96 summarizes all roadless area allocations by category across the alternatives.

Table 3-96. Roadless area allocation by alternative (percentage of the area)

Roadless Area	**Alt. A**	**Alt. B**	**Alt. D**	**Alt. E**	**Alt. F**	**Alt. G**	**Alt. I**
Bee Cove	W 100 %	W 100 %	N 100 %	W 100 %	N 100 %	W 100 %	R 100 %
Big Mountain (SC portion)	R 97 %, N 3 %	W 100 %	R 97 %, N 3 %	R 97 %, N 3 %	R 100 %	W 100 %	R 100 %
Ellicott Rock 1	W 100 %	W 100 %	W 100 %	W 100 %	W 100 %	W 100 %	W 100 %
Ellicott Rock 2	W 100 %	W 100 %	W 100 %	W 100 %	W 100 %	W 100 %	W 100 %
Total % for all Areas	W 99 % N 1 %	W 100 %	W 13 % R 37 % N 50 %	W 99 % N 1 %	W 13 % R 38 % N 49 %	W 100 %	W 13 % R 87 %

W=Recommended Wilderness Study

R=Roadless Areas Maintaining Roadless Character

N=Roadless Areas Not Maintaining Roadless Character

Recommended Wilderness Study

Designation as wilderness study areas would preserve additional areas that would be managed to allow natural processes to occur, provide areas for solitude and primitive recreation, and minimize the impacts of humans and their activities on the land. These areas would be islands within the forest where the naturalness, uniqueness, and representative ecosystems of the designated areas would be maintained. The highest priority for management would be to manage for the naturalness of the area.

Roadless areas recommended for wilderness study are set aside for future designation as wilderness and are not available for activities such as vegetation management or road construction. These areas are managed much the same as designated wilderness until a final determination is made by Congress as to whether they will be added to the National Wilderness Preservation system. Roadless areas recommended for wilderness study are displayed in Table 3-97. All the inventoried roadless areas are in the same ecosystem: Central Appalachian broadleaf-coniferous forest meadow province, Blue Ridge section, Southern Blue Ridge Mountains subsection. This ecosystem is represented currently by designated wilderness on the forest as well as those that would potentially be added after wilderness studies are completed.

Table 3-97. Numbers of Acres Allocated to Recommended Wilderness Study by Alternative

Roadless Area	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F	Alt. G	Alt. I
Number of Areas	3	4	2	3	2	4	2
Acres	7,638	7,068	2,106	5,083	2,281	6,293	1,982

Direct effects of managing wilderness study areas include maintaining soil, hydrologic, and atmospheric conditions prevailing in the areas. Roads will be closed and rehabilitated or allowed to return to natural state. Water quality and air quality should remain high and the imprint of human influence will not increase or will diminish over time.

Opportunities for solitude and remoteness will increase as will the opportunity for primitive and unconfined recreation due to road closures and prohibited motorized use. Non-motorized dispersed recreation activities such as hiking, horseback riding, camping, fishing, and hunting would continue and use-levels would be expected to remain about the same as current levels. Visual and experiential contrasts between roadless areas and other timbered lands will increase. Additional acreage for wilderness study will increase the carrying capacity and allow for user impacts to be dispersed across a larger area, providing an increase in wilderness visitor satisfaction. However, road closures will result in decreased access for some activities. A decrease in opportunities for bicycling, off highway vehicles, and other forms of recreation requiring motorized transport or

mechanized equipment will result. Bicycle and motorized use would be displaced to other areas.

Maintenance of hiking trails and facilities will be done using hand tools only and access will be made using non-mechanized/non-motorized means. The minor amount of developed recreation use and other use associated with motor vehicles currently taking place in these areas will cease.

Research indicates there will be an increase in visitation and an increase in economic benefits resulting from tourism in the surrounding local communities. However, there will also be a reduction in economic benefits associated with the management, harvesting, manufacturing, and retail sale of timber products from the roadless areas since timber management activities would not be allowed in these areas. There will be reduced opportunities to recover commercial minerals and mineral exploration and development will be hindered.

Little or no mineral development or its associated impacts would be expected under any alternative. There are no existing federal oil or gas leases or other federal mineral leases in effect in any of the areas recommended for wilderness study. The potential for development of energy minerals and other leasable and common minerals is estimated to be low. These areas would be administratively unavailable for federal oil and gas and other federal mineral leases, pending final Congressional action. These areas are not available for mineral materials for commercial purposes. Administrative use of mineral materials is allowed, but use and impacts would be extremely low.

Educational opportunities for the scientific study of natural ecological processes will increase in alternatives that increase wilderness or wilderness study.

The naturalness, uniqueness, and representative ecosystems of the designated areas will be maintained. Natural ecological processes will continue, including plant succession. Larger blocks of undeveloped land and reduction in open road density in areas recommended for wilderness study will favor area sensitive and disturbance sensitive species. Existing old fields, wildlife openings, and other habitat improvements for fish and wildlife would not be maintained in areas recommended for wilderness study. Early successional habitat areas will succeed to forest. New permanent wildlife openings will not be created. These factors will reduce habitat for early successional species. Fish stocking in areas recommended for wilderness study would be restricted to reestablishment or maintenance of indigenous, threatened, endangered, or native species. Species traditionally stocked before wilderness designation may be considered for stocking if species is likely to survive.

Fire management may be affected by designation of additional wilderness areas. Fire suppression of all human-caused wildfires would minimize the potential effects on wilderness values, however fires in these areas would likely become larger in size than they would under current management because of the restrictions on motorized equipment such as dozers. Under emergency situations, mechanized equipment and

motorized transport, use of helicopters, air tankers, and other aircraft may be approved by Forest Supervisors and/or Regional Forester. These actions would impact wilderness character and visitor experiences and leave evidence of humans, although rehabilitation could help to reduce those impacts afterward.

Lightning ignited fires, if allowed to burn, may benefit some types of recreation by opening up the forest, reducing fuel loading to acceptable levels, and maintaining the vegetation. There would be a short-term negative impact to air quality, visual aesthetics, and possibly, water quality.

Management ignited fires to reduce hazardous fuels can have negative results in wilderness through changes in vegetation types, impacts to wilderness visitors and experiences, water quality, and habitat within wilderness. It can, however, benefit the wilderness by reducing fuel loadings to acceptable levels such that naturally ignited fires may be returned to the wilderness or wilderness study area. Fire prevention strategies applied in the urban interface area on private land can reduce the need for management-ignited fires.

Additional effects to wilderness study areas are similar to those found in wilderness: soil compaction, vegetation loss or disturbance, non-native species, crowding and loss of solitude, deterioration of water quality from improper disposal of human waste and waste water; and loss of or threats to biological/ecological processes and biodiversity through human disturbance.

Roadless Areas Maintaining Roadless Character

Areas identified as *roadless areas maintaining roadless character* will be assigned to prescriptions that would manage in ways very similar to and have overall effects similar to those in wilderness or wilderness study. The management of these areas will strive to protect the natural process and minimize the impact of humans. No active timber management or permanent road construction is prescribed in any of the alternatives for these areas. However, sights and sounds of human's activities may increase under these prescriptions and some opportunity for solitude would be diminished due to a broader range of activities under the various prescriptions. Some recreation facilities may be constructed to enhance the visitor's experience. Management ignited fire would be used to maintain fuel loadings and mechanized equipment and motorized vehicles would be used.

Roadless Areas Not Maintaining Roadless Character

In this category, areas are made available for management allocations involving road construction and/or timber harvest. This means that changes are allowed that can make an area no longer suitable for wilderness designation or may no longer provide primitive or semi-primitive settings. This category does not necessarily commit an area to

development. Before a decision is made to build roads or harvest timber in a roadless area, a site-specific analysis must be conducted.

The roadless character in many of these areas may be diminished over time. The naturalness of these undesignated areas may be reduced by the interruption of natural ecological processes. Vegetation composition and structure may be manipulated, resulting in a greater diversity of age-classes among forest types. Opportunities for solitude and remoteness may decrease. Sights and sounds of human's activities may be more obvious. Additional roads and trails may be constructed. Noise levels and soil erosion may increase and air and water quality may decrease, but water quality will meet state and federal standards.

Roadless Area Conservation Rule

On January 12, 2001, the Roadless Area Conservation Rule (RACR) was published in the ***Federal Register*** (36 CFR 294). The Roadless Area Conservation Rule prohibited with certain exceptions, road construction and reconstruction activities; and the timber cutting, sale, or removal activities that could occur in the inventoried roadless areas (IRAs) identified in the RACR FEIS. The RACR in 36 CFR 294.12 and 294.13, identified the exceptions where road construction/reconstruction activities and timber cutting/removal activities would be allowed. The RACR had an effective date of March 13, 2001. This effective date was later delayed until May 12, 2001.

Subsequently, several groups and States filed lawsuits challenging the RACR. On July 14, 2003, the United States District Court, Wyoming District (Judge Clarence Brimmer) found the Roadless Area Conservation Rule to be in violation of the National Environmental Policy Act and the Wilderness Act, and permanently enjoined its implementation and set the rule aside. The effect of this ruling is that direction for inventoried roadless areas reverts to the direction provided in the Revised Forest Plan. However, this issue is not settled. Appeals of the Wyoming District Court decision, other litigation, new rulemaking, or new Forest Service directives could result in a change in direction for the management of inventoried roadless areas.

The management approach in this Revised Forest Plan emphasizes conservation of roadless values and characteristics in all of the inventoried roadless areas. However, Bee Cove Roadless Area and parts of Big Mountain Roadless Area (the part that is outside the Chattooga Wild and Scenic River Corridor and outside the 12A prescription) would allow timber cutting/removal activities or road construction/reconstruction activities that do not meet the intent of the RACR. (See the discussion on Issue #8 in this Record of Decision, and the section on "Roadless Area Conservation Rule" in Chapter 3 of the FEIS, for more information).

In managing the roadless areas, the Sumter National Forest will follow the management direction contained in this Revised Forest Plan and any Forest Service policy on roadless area management specified in the Forest Service directives. However, should the RACR

become effective, it will supercede this Revised Plan for those inventoried roadless areas identified in the RACR FEIS that was completed in November 2000. This would mean that those areas in the Revised Forest Plan that are identified as available for treatment, could not be treated unless they meet the exceptions in the RACR. According to 36 CFR 294.14(b), should the RACR become effective, an amendment to this Revised Forest Plan would not be needed to implement its direction.

In Alternatives A and E, all of the inventoried roadless areas except 3% of Big Mountain (on the South Carolina side of the Chattooga River) would be recommended for wilderness or would maintain their roadless characteristics. The remaining acres are allocated to 7E2 prescription that allows road construction, habitat manipulation, and some vegetation manipulation, which may not be consistent with the Roadless Rule.

In Alternatives B and G, all the inventoried roadless acres are recommended for wilderness. These areas would maintain their roadless character and would be consistent with Roadless Rule.

In Alternative I, Ellicott Rock 1 and 2 would be recommended for wilderness, and both Big Mountain and Bee Cove Roadless Areas would have their roadless characteristics maintained.

In Alternative D, Ellicott Rock 1 and 2 would be recommended for wilderness, and 97% of Big Mountain would have its roadless characteristics maintained. Three percent of Big Mountain and all of Bee Cove would be allocated to management prescriptions 4D and 10B. Prescriptions 4D and 10B would allow some road construction, habitat manipulation, and some vegetation manipulation, which may not be consistent with the Roadless Rule.

In Alternative F, all the acres in Ellicott Rock 1 and 2 would be recommended for wilderness. Ninety-seven percent of Big Mountain would have its roadless character maintained. These areas would maintain their roadless character and would be consistent with Roadless Rule. About 3% of Big Mountain would allow for timber harvest and road construction. This would not be consistent with the Roadless Rule. The acres in Bee Cove are allocated to management prescriptions 4D and 10B which allow some road construction, habitat manipulation, and some vegetation manipulation, which may not be consistent with the Roadless Rule.

Scenery

Affected Environment

Large portions of the Sumter National Forest's 364,700 acres can be seen from roads, trails, and waterways. The more scenic landscapes are generally associated with or occur adjacent to lakes, rivers, and streams, or highly developed recreation areas and national trails. Views beyond the immediate foreground are influenced by terrain as well as vegetation type and density. The Andrew Pickens Ranger District is mountainous and covered with an almost-continuous canopy of deciduous and coniferous vegetation, creating a natural-appearing landscape character. There are occasional vistas at certain points along some roads and trails. The two piedmont districts, the Long Cane and the Enoree, have rolling hills and are interspersed with private ownership. This flatter terrain has fewer vistas.

Of the seven land-use themes described in the Scenery Management System, the Sumter National Forest landscapes can be grouped predominantly into three: natural evolving, natural appearing, and rural-forested. (*Landscape Aesthetics, A Handbook for Scenery Management, Agricultural Handbook Number 701*, p. 1-3). The vast majority of the forest (approximately 359,000 acres) is characterized as natural appearing. Designated wilderness and recommended wilderness study areas (approximately 5,000 acres) are lands where ecological processes predominate and are characteristically natural evolving landscapes. Rural-forested is a very small category that includes the forest's most highly developed recreation areas, approximately 600 acres.

Landscape character is a reflection of the physical, biological, and cultural attributes in the landscape, and the beliefs, values, and attitudes that people assign to these attributes. The landscape character has its origins in and is informed by early settlement patterns and land uses that have taken place over the years. These early and continuing influences affect the attitude toward landscape uses today. It is the physical appearance and cultural context of a landscape that gives it an identity and a "sense of place."

On the Sumter National Forest, the Andrew Pickens Ranger District is located within Central Appalachian broadleaf-coniferous forest meadow province and Blue Ridge Mountain section as described by Bailey and others (1994). The landscape character of this section is characterized by the highest elevation peaks, plateaus, valleys, and coves in the eastern United States; a cool climate; swift whitewater streams and rivers; a high degree of biological diversity; and outstanding scenery that supports a wide array of recreation opportunities. Since most human habitation has been confined to the valleys and plateaus, this section is also characterized by a relatively high percentage of natural appearing, naturally evolving, and remote landscape settings, that enable the Blue Ridge to be widely recognized for its outdoor-oriented natural environment.

On the Sumter National Forest, the Long Cane and Enoree Ranger Districts are located in the southeastern mixed forest province and the Southern Appalachian piedmont section, as described by Bailey and others (1994). Moderate elevations, a moderate climate, and a moderate density of small to medium streams and some larger rivers characterize the

landscape character of this section. Since most of the area has been inhabited for centuries, and first trails and then roads were common, there are no large areas of remote landscape settings. The areas do provide good recreation opportunities such as hunting.

In the past, scenic resource management direction was determined by the visual management system (VMS). From that system, visual quality objectives (VQOs) described the degree of alteration (including vegetation manipulation) that was acceptable in the landscape. Preservation was the least altered landscape and maximum modification was the most altered. (The Sumter National Forest had no acres of maximum modification in the 1985 Forest Plan.) In 1995, the scenery management system (SMS) replaced the VMS. The scenic resource has been re-inventoried to comply with the new terminology and the new system. (See *Landscape Aesthetics*, *A Handbook for Scenery Management,* Agricultural Handbook Number 701). To see how the two systems relate, Table 3-98 is a crosswalk between the old system and the new.

Table 3-98. Crosswalk between VQOs (Visual Management System) and SIOs (the updated Scenery Management System)

Visual Quality Objective (VQO)	**Scenic Integrity Objective (SIO)**
Preservation (P)	Very High (VH)
Retention (R)	High (H)
Partial Retention (PR)	Moderate (M)
Modification or Maximum Modification (M)	Low (L) or Very Low (VL)

The current inventory (from the 1985 Forest Plan) is expressed in acres using the older VMS system (Table 3-99). In the environmental consequences section below, the acres will be expressed in the newer system, SMS.

Table 3-99. VQO Current Inventory

Visual Quality Objectives	***Acreage***	***% of Land base***
Preservation (P)	19,350	5%
Retention (R)	12,000	3%
Partial Retention (PR)	10,050	3%
Modification (M) or Maximum Modification (MM)	317,750	89%
TOTAL	359,150	100%

Special Places are specific locations and expanses in outdoor settings that have attractions and features that are identified as unique, different, distinctive, and extraordinary to people. These can be indicators of highly valued scenic places. A comprehensive inventory of constituents' special places has not been conducted on the Sumter National Forest.

Direct and Indirect Effects

The scenic resource is affected by management activities altering the appearance of what is seen in the landscape. Short-term scenic effects are usually considered in terms of degree of visual contrast with existing or adjacent conditions that result from management activity. The scenic landscape can be changed over the long-term or cumulatively by the alteration of the visual character. Management activities, which result in visual alterations inconsistent with the assigned SIO, even with mitigation, affect scenery. Management activities that have the greatest potential of affecting scenery are road construction, vegetation management, insect and disease control, special use utility rights-of-ways, and mineral extraction. Other management activities that also can effect the scenic resource at a lesser degree are threatened and endangered (T&E) species habitat management, prescribed burning, fire suppression, land exchange, old growth forest management, recreation, administrative site facility construction, and wildlife management. See Table 3-100 for SIO allocation by alternative**.** (For planning purposes, SIOs were established for each prescription. These range from Very High (VH-unaltered) to Low (L- moderately altered). The SIOs define the different levels of alteration affecting the visual resource that are acceptable.)

Table 3-100. SIO Acres by Alternative

	A	B	D	E	F*	G	I
Very High	15,600	16,500	14,800	16,300	20,200	42,300	15,600
High	47,800	43,400	40,600	67,600	27,000	33,000	47,500
Moderate	110,900	131,600	67,500	131,800	22,400	198,000	112,800
Low	182,700	165,500	234,100	141,300	287,400	83,700	181,100
Not inventoried (water, new ownership, etc.)	5,850	5,850	5,850	5,850	5,850	5,850	5,850
Total	362,850	362,850	362,850	362,850	362,850	362,850	362,850

Alternative F is based on the SIO prescribed by a crosswalk of the existing allocations and the prescriptions. The acres in this table express the SIO for the prescriptions. Some alternatives have areas that have the same SIO assigned in each alternative. Wilderness and recommended wilderness and wild sections of designated or recommended wild and scenic rivers always have a high or very high SIO.

Alternatives E and G have the highest acreage in SIOs Very High, High, and Moderate resulting in more protection and enhancement to the scenic resources than alternatives having fewer acres assigned to the higher SIOs. Alternatives F and D have the most acres assigned to Low SIO. Therefore, negative impacts to scenery from road construction, vegetation management, insect and disease control, special use utility rights-of-ways, and mineral extraction would be the greatest in Alternative F and D. Many of these impacts would be avoided by implementing mitigation measures.

In all alternatives there is little to no change in the landscape character themes of natural appearing and natural evolving.

All alternatives propose prescribed burning; cycles will vary**.** Drifting smoke and blackened vegetation and charred tree trunks would be the main negative visual effect. Visual contrast from fire line construction would also be evident. The contrast levels and duration vary with fire intensity. Blackened vegetation usually lasts a short time, but charring of trees may be evident for many years. Repetitive burning reduces overall visual diversity. It often results in loss of valued mid- and understory species such as flowering dogwood, but tends to promote herbaceous flowering species. Prescribed fire repeated over time produces stands with open understories allowing views farther into the landscape. Alternatives B and E have the most impacts from prescribed burning. Alternative G has fewer impacts from prescribed burning. Alternatives A, D, F, and I have more moderate amounts of burning. (See Appendix K, Probable Activities by Alternative.)

Insect infections and diseases can cause strong, unattractive contrasts in the landscape. Since the late 1990s, as a result of the Southern Pine Beetle infestation that killed large numbers of pines, part of the canopy has opened on both the mountain and the piedmont districts. Groups of tall, gray, defoliated stems, varying from less than an acre to more than 25 acres, eventually give way to an emerging deciduous and evergreen understory. This process is speeded by active salvage operations in areas where human health and safety is critical. Management efforts to control insect infestations and diseases can minimize or reduce effects. Control efforts that include removal of infected trees and buffer areas often appear as clearcutting to forest visitors. These impacts can occur in areas of high scenic value. Alternative G has the most risk for impacts from insects and disease. Alternatives F and D have the least risk for impacts from insects and disease. Alternatives A, B, E, and I have moderate risk. (See Appendix K, Probable Activities by Alternative.)

Utility rights-of-way (ROW) have a high potential of affecting the scenic resource for a longer duration. Cleared ROWs and utility structures contrast and may be incongruent with existing landscape. Cleared ROWs contrast in form, line, color, and texture when compared to the natural appearing landscape**.** Most of the alternatives have a similar number and amount of impacts from utility ROWs.

Mineral management and development activities can involve major landform alteration, as well as form, line, color, and texture contrasts, causing substantially adverse scenic impacts**.** Alternatives with lands that are not available for lease, have a no-surface-use stipulation, or controlled-surface-occupancy stipulation will have fewer effects on visual resources than alternatives that allow standard leasing stipulations. Alternative G has the most of these types of stipulations and Alternative F has the least.

Road construction, reconstruction, and maintenance, including rights-of-way maintenance, affect scenery. Mowing frequency and timing alters the appearance of the landscape. Road construction introduces unnatural visual elements into the landscape and causes form, line, color, and texture contrasts. Road management controls how much of the landscape is seen by having roads open or closed. Alternatives F and D have the most impacts from ROW maintenance and road construction and reconstruction. Alternatives G and B have the fewest impacts from ROW maintenance and road construction and reconstruction.

Vegetation management has the great potential to alter the landscape and impact the scenic resource. Vegetation management practices can cause long-term effects on scenery by altering landscapes through species conversion, reduction in species diversity, manipulation of the prominent age class, and alteration of opening size, location, and frequency. The potential effects may be positive or negative, depending on their consistency with the desired future condition of the landscape.

Of the management applications, even-aged management may be the most impacting. Among the even-aged regeneration methods, clear-cutting and seed-tree harvest produce the highest visual contrasts because they remove the most forest canopy and create openings. These openings would vary in their effects on scenery depending on size, shape, location, and nearness to other openings. Openings that repeat the size and general character of surrounding natural openings and the landscape character would impact scenery the least. Alternative F has the most impacts from even-aged management. Alternatives G and B have the fewest impacts from even-aged management. (See Appendix K, Probable Activities by Alternative.) Single-tree selection and group selection harvests are normally less evident because they do not cause large openings in the canopy. Uneven-aged regeneration methods can affect scenery, causing contrasts in form, line, color, and texture from slash production. Although smaller in relative acres to even-aged management, Alternative B has the most acres in uneven-aged management, and Alternative A, E, and D have the fewest. All impacts as a result of timber harvest are short-term because of rapid vegetation growth.

Site preparation activities affect scenery by exposing soil and killing other vegetation. These effects are generally short-term. Site preparation usually improves the appearance of the harvest area by removing the unmerchantable trees and most of the broken stems. Stand improvement work can affect scenery by browning the vegetation and by reducing visual variety through elimination of target species**.** Alternatives F, A, and D have the most impacts from site preparation activities. Alternatives G, B, E and I have the fewer

impacts from timber harvesting and site activities. (See Appendix K, Probable Activities by Alternative.)

Forestwide mid-story manipulation is common wildlife management practice. Mid-story removal (along with prescribed burning) reduces overstory diversity, often resulting in the loss of valued scenic resources such as flowering dogwoods. Mid-story removal in time produces stands with open understories allowing views into the landscape. Alternatives B, E, and I have the most impacts from mid-story removal activities. Alternatives A, D, G, and F have the fewest impacts from mid-story removal and prescribed burning activities. (See Appendix K, Probable Activities by Alternative.)

Recreation facilities are also deviations to the natural landscape that have long-term effects. Forest Service recreation facilities are designed to blend into the landscape without major visual disruption. Trail construction introduces some unnatural visual elements into the landscape and causes form, line, color, and texture contrasts. Alternatives A, E, and I have the most impacts from recreation facility and trail construction activities. Alternatives B, F, D, and G have the fewest impacts from recreation facility and trail construction activities. (See Appendix K, Probable Activities by Alternative.)

Designation of wilderness will generally cause positive effects to the scenery. Old-growth forest character will be created over time. Alternatives A, B, and G have the most acres in recommended or designated wilderness. Alternatives D, F, and I have the fewest acres in recommended or designated wilderness.

For the most part, Special Places are not affected across alternatives. However, the inventory list is not exhaustive and will change over time as more sites are inventoried. Buffers needed to protect the character of each individual special place will vary by site.

Special Areas

Affected Environment

Special area designation is to protect, and where appropriate, foster public use and enjoyment of, areas with scenic, historical, geological, botanical, zoological, paleontological, and archeological characteristics, and other characteristics of interest. Special areas may be designated administratively or may receive designation by law. Other uses are permitted in these areas to the extent that these uses are in harmony with the designation.

On the Sumter National Forest there are botanical areas, scenic areas, scenic byways, and experimental forests.

Botanical areas are lands that serve as core areas for conservation of significant elements of biological diversity. These areas perpetuate or increase existing individual plant or

animal species that are of national, regional, or state significance as identified on T/E/S lists; perpetuate plant and animal communities that are unique or uncommon at the scale of their ecological section or subsection unit; and allow for public use and enjoyment. There are several botanical areas on the Sumter National Forest (Tables 3-101 and 3-102). Since the 1985 plan, several botanical areas were assessed and were found to have the necessary values to recommend them for special area designation. These resulted from several botanical inventories on the forest, including Gaddy (1996). Table 3-101 lists the special areas found on the Sumter National Forest, and Table 3-102 lists the new areas included under Alternative I.

Scenic areas are lands that have a high level of scenic values and natural beauty. There are several scenic areas on the Sumter National Forest. They represent some of the loveliest areas on the forest in terms of visual variety and appeal. They range from whitewater river corridors to bottomland hardwoods in the piedmont. Since the 1985 plan, several scenic areas were assessed and were found to have the values necessary to recommend them for special area designation or to be enlarged. Table 3-101 lists the special areas found on the Sumter National Forest and Table 3-102 lists the new areas.

Scenic byways are lands that provide visitors with outstanding scenery of natural and cultural landscapes along a well-maintained road. These byways protect and showcase the scenic natural and cultural resources of the area. The Oscar Wiggington National Forest Scenic Byway is a 14.5-mile scenic byway that winds through the Andrew Pickens Ranger District of the Sumter National Forest along South Carolina State Highways 107 and 413.

Experimental forests are lands that provide the current and future research needs of the Southern Research Station and demonstrate common forestry practices to non-industrial private forest landowners**.** The Calhoun Experimental Forest has a variety of conditions that meet the research needs of the Southern Research Station. Aside from demonstration, the main need of the station currently is to maintain various age classes and conditions for future research. There is a 908-acre natural area within the experimental forest where old growth conditions will develop over time.

Table 3-101. Existing Special Areas on the Sumter National Forest

District	Special Areas	Acres*
Scenic Areas		
Andrew Pickens	Chauga	3,300
	White Rock	3,416
Long Cane	Long Cane	695
Enoree	Broad River/Henderson Island	435
Botanical Areas		
	Lee Falls	180

Andrew Pickens	Lee Falls	180
Long Cane	Turkey/Stevens Creek / Station Cove	1,050 / 200
Forest Service Scenic Byway		
Andrew Pickens	Oscar Wiggington	14.5**
Experimental Forest		
Enoree	Calhoun	4,965

**Acreages are based on the allocations in the 1985 Sumter Forest Plan*

***Units in Miles of scenic byway*

Table 3-102. New Special Areas on the Sumter National Forest

District	Special Areas	Acres
Scenic Areas		
Andrew Pickens	Chauga (area enlarged)	3,459
Enoree	Sandy River	203
	Lower Rennick's Branch	40
Botanical Areas		
Andrew Pickens	Brasstown Creek and Falls	1381
	Cedar Creek Natural Area	517
	King Creek	45
	Opossum Creek	119
	Tamassee Knob and Coves/Tamassee Creek	945
Long Cane	Parson's Mountain Monadnock	135
	Post Oak Savanna	94
	Turkey/Stevens Creek	1,925

Direct and Indirect Effects

The amount of special areas allocated to the special areas prescriptions is described by alternative in Table 3-103.

Table 3-103. Special Areas (in acres) by Alternative

	A	B	D	E	F	G	I
Scenic Areas							
4F	1,284	2,328	4,978	2,341	8,642	5,711	10,020
Botanical Areas							
4D	3,931	3,171	2,917	4,410	1,557	4,953	4,399
Scenic Byway							
7A	0	0	0	0	0	0	3,044
Experimental Forest							
4G1	4,862	4,862	4,862	4,862	4,862	4,862	4,862

Scenic Areas

The acreage in scenic areas will vary somewhat across alternatives. (Table 3-103) Some scenic areas were added in all alternatives, compared to current (Alternative F). Effects of forest management on scenic areas are determined by the emphasis of the prescriptions in which they are allocated. Effects to scenic areas, even in prescriptions other than scenic areas, will be minimal given the high values placed on scenery of those areas in the scenery management system. The designation of scenic areas could bring increased recreational traffic into these areas. This dispersed recreation could have some negative impact, including trampling of vegetation, soil compaction, increased erosion, and sedimentation from trails. There is also the possibility of introduction of noxious weed species which when introduced into scenic areas, can start infestations of invasive weeds into systems of native species.

In some alternatives, some scenic areas are not designated. The effects of this may be that the unique character of areas would remain unrecognized by the public and the areas would lack special protection from normal management activities and generally, lack management designed to enhance the unique characteristics of an area. Future designation might be precluded by resource development activities such as road building or natural events, such as fire or flood.

Alternatives F and I allocate the highest number of acres to the scenic area prescription and Alternatives A, B, and E allocate the least number. Alternatives D and G allocate number of acres between the most and the least.

Botanical Areas

The acreage in botanical/zoological areas will vary somewhat across alternatives (Table 3-103).

Several botanical areas were added in all alternatives, compared to current (Alternative F). All alternatives will result in an increase in opportunities for public use and enjoyment of botanical/zoological values compared to current management. The differences in acreages among the remaining alternatives is not likely to influence the core botanical/zoological values for which they were designated, but could result in the loss of some older upland forest types. Inventories regarding the significance of communities associated with the upland areas occurring adjacent to these areas are currently lacking. Significant elements of botanical diversity, rare communities, will be managed under the rare community prescription (9F) across all alternatives, wherever they occur. Buffers will be identified in conjunction with more site-specific analysis, as needed.

The Turkey/Stevens Creek corridor remains in botanical/zoological area designation (Alternatives E, F, and G), and is expanded under these alternatives, and receives no designation in Alternative A. However, the outstandingly remarkable botanical/zoological values will be protected under all alternatives based on a forestwide standard. In Alternatives B, E, and G, the botanical/zoological areas on the Andrew Pickens are somewhat larger, and Poor Mountain is added as a botanical/zoological area. The additional acreage is in upland pine and hardwood forest, including some Table Mountain pine at Poor Mountain. The exclusion of these additional areas in the proposed forest plan is likely to decrease the value of these lands in providing for older forests in the future, and could make them more vulnerable to edge effects such as an increased opportunity for invasion by non-native invasive plant species. This effect is likely to be insignificant to the unique botanical/zoological values, since any rare communities identified in association with these areas will be managed according to the rare community prescription (9F). The Jemike Coves area will be managed through the rare community prescription under Alternative I.

The designation of botanical/zoological areas could bring increased recreational traffic into these areas. This dispersed recreation could have negative impacts on botanical/zoological areas from trampling of vegetation, soil compaction, increased erosion and sedimentation from trails, or from recreational plant collection or flower picking which could severely affect some rare species.

Alternatives A, E, and G allocate the highest number of acres to the botanical/zoological area prescription and Alternatives F and I allocate the least number.

Scenic Byways

The Oscar Wiggington Scenic Byway will be managed in a variety of prescriptions that vary across alternatives (Table 3-103). Effects of forest management on the scenic byway would vary depending on the emphasis of the prescription. The designation of a national forest scenic byway does help emphasize the management in the scenic byway corridor, regardless of the management prescription. For those prescriptions where the byway passes through, emphasis of these areas would still need to be compatible with the objectives of a national forest scenic byway designation.

Alternative I allocates the highest number of acres to the prescription for Scenic Byway corridors. The effect of this allocation is increased emphasis on the scenic quality of the corridor. There may be increased amounts of interpretation and management of spring and fall flowering trees along the road edges. Tourism might be increased with better facilities and emphasis. The remaining alternatives allocate the scenic byway to a variety of other prescriptions, including remote backcountry and wildlife management. Effects to scenic byways, even in prescriptions other than scenic byway prescriptions, will be minimal given the high scenic value of the national scenic byway designation.

Experimental Forest

Management prescriptions do not vary by alternative for the Calhoun Experimental Forest (Table 3-103). National forest research determines the management emphasis in cooperation with the Sumter National Forest. The differences between alternatives in effects to the Calhoun Experimental Forest would be negligible.

Wild and Scenic Rivers

<u>Affected Environment</u>

Designated Rivers – Regional Overview

The Wild and Scenic Rivers Act (Public Law 90-542: 16 USC 1271-1287, October 2, 1968) and its amendments provide for the protection of selected rivers and their immediate environments. To be eligible for designation, rivers must possess one or more outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Designation preserves rivers in free-flowing condition, protects water quality, and protects their immediate environments for the benefit and enjoyment of present and future generations.

Most rivers are added to the National Wild and Scenic Rivers System (National System) through federal legislation, after a study of the river's eligibility and suitability for designation. The Forest Service is required to consider and evaluate rivers on lands they

manage for potential designation while preparing their broader land and resource management plans under Section 5(d)(1) of the Act.

According to the Southern Appalachian Assessment (SAA), the national forests in the Southern Appalachians were established early in the 20th century primarily to protect the headwaters of major rivers from land uses that encouraged flooding, erosion, and stream sedimentation. Some would argue that clean water for the surrounding cities is the region's most important product. The Southern Appalachians contain parts of 73 major watersheds: 29 are wholly within the SAA region, 18 have more than one-half within the region. Nine major rivers that rise in the Southern Appalachians provide drinking water to the major cities in the southeast.

Rivers and stream corridors accommodate a lot of different uses such as picnicking, fishing, day hiking and walking for pleasure, primitive camping, boating (canoeing, kayaking, rafting, tubing), swimming, and nature study. The *National Survey on Recreation and the Environment 2000* interviewed over 15,000 people to determine participation in a variety of activities. According to the results, 76.1 reported participating in boating (including rafting, kayaking and canoeing) and 20 million participated in rafting, tubing, or any other type of floating on flowing waters. Over 27 million reported fishing in cold-water streams, rivers, and lakes for trout. According to the SAA Social, Cultural, and Economic Technical Report, trends in the percentage of participation in all of these activities increased from 1972 to 1992. The largest increases in participation over the 20 years occurred in pleasure walking (34.3%), nature study (25.3%), and day hiking (16.9%).

Demand for river designation is expressed primarily through public comment and responses to agency proposals. The degree to which public input favors designation indicates the demand for a wide range of uses, activities, and resource qualities associated with river management. Although demand is closely related to the current population and the projected growth of the local area, designation would likely produce increased levels of recreation use in designated and potential corridors.

The Southern Appalachians currently have five wild and scenic rivers totaling 191.1 miles. All but 45.3 miles are managed by the national forests. Of the 145.8 miles of designated river managed by the Forest Service, 80.8 miles are classified as wild, 34 miles as scenic, and 31 miles as recreational.

Designated River on the Sumter National Forest

The Sumter National Forest has one designated wild and scenic river, the Chattooga River, which was designated on May 10, 1974, as one of the original streams in the National Wild and Scenic River System. The outstandingly remarkable values of the Chattooga River include water quality, biological/wildlife, ecological, botanical, fisheries, scenery, and recreation. It is one of the premier whitewater streams of the eastern United States. Its 57 designated miles begin in North Carolina and become the state boundary between

South Carolina (Sumter National Forest) and Georgia (Chattahoochee National Forest). The Sumter National Forest has the lead for administrative duties.

Use on the Chattooga River fluctuates each year based on the water. In higher water years, the use for both guided and self-guided use has reached as high as 89,000 people per year and in lower water years, the number can be significantly lower. Management of the guided and self-guided river use remains the same for each alternative.

Appendix H of this EIS will analyze the effects of opening all or part of the Chattooga Wild and Scenic River above Highway 28 to whitewater boating. Opening up these sections of the river to boating was an issue raised during the public involvement processes for the Sumter Forest Plan Revision and Amendment 14 of the existing Sumter Plan.

Non-Eligible/Eligible Rivers on Sumter National Forest

In previous planning efforts, rivers on the Sumter National Forest were considered for wild and scenic river eligibility. Eligible rivers from that assessment were placed in management in the forest plan that protected their outstandingly remarkable values until a suitability determination was completed. Five rivers were studied and only the Chauga River was eligible. It was placed in a scenic area and its outstandingly remarkable values are protected.

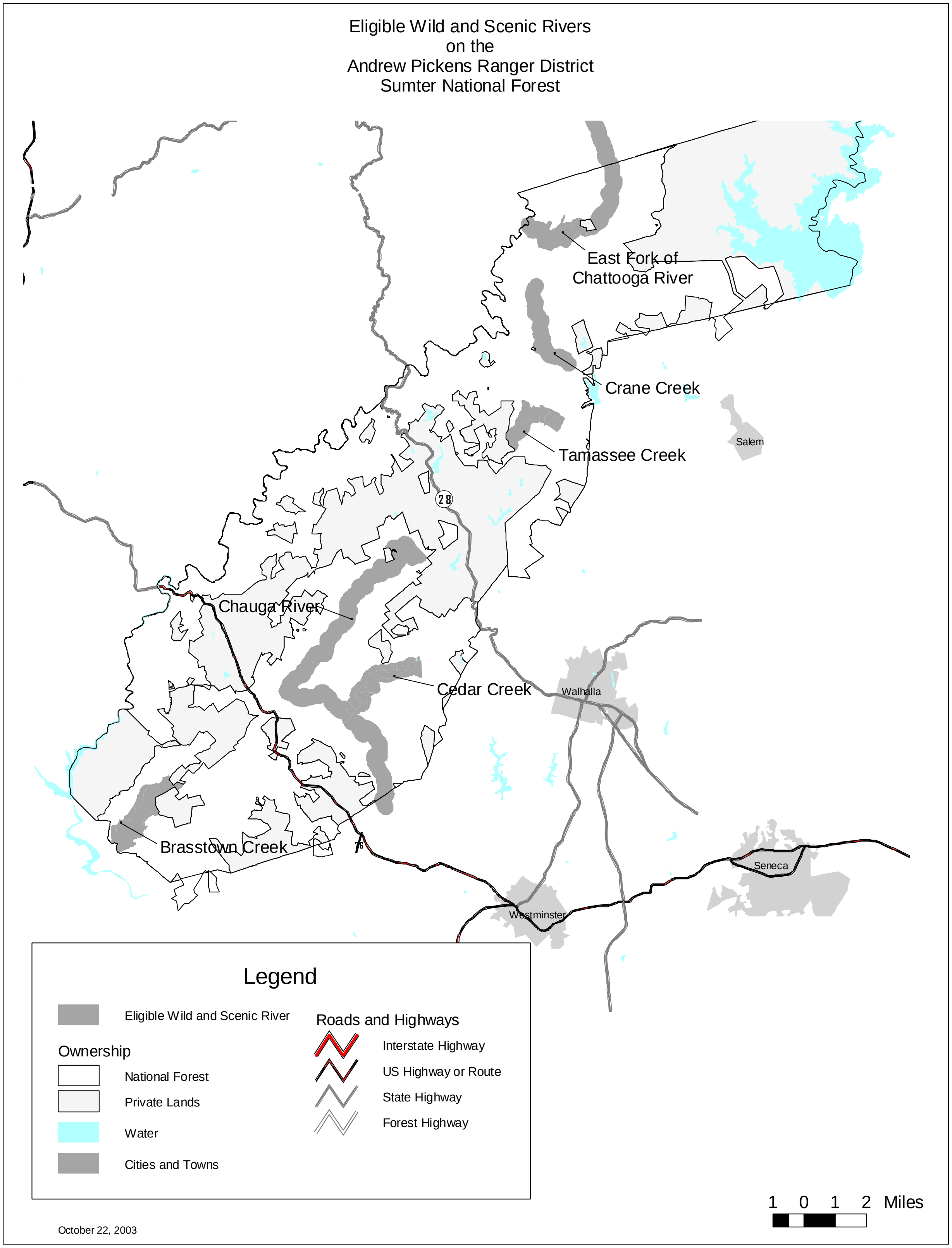
During the current planning effort, another comprehensive inventory was done. This inventory included a river identified on the National Rivers Inventory, the South Carolina Statewide River Assessment, and through public involvement. Seventeen streams or rivers on the Sumter National Forest were reviewed for potential eligibility. Of the 17, eight were found to be eligible based on their outstandingly remarkable values. Rivers/streams must possess at least one outstandingly remarkable value to be considered eligible. These streams were classified according to Section 2 of the WSR act (PL 90-542). Table 3-104 shows the rivers that were studied and found ineligible and Table 3-105 shows the rivers that were studied but found eligible.

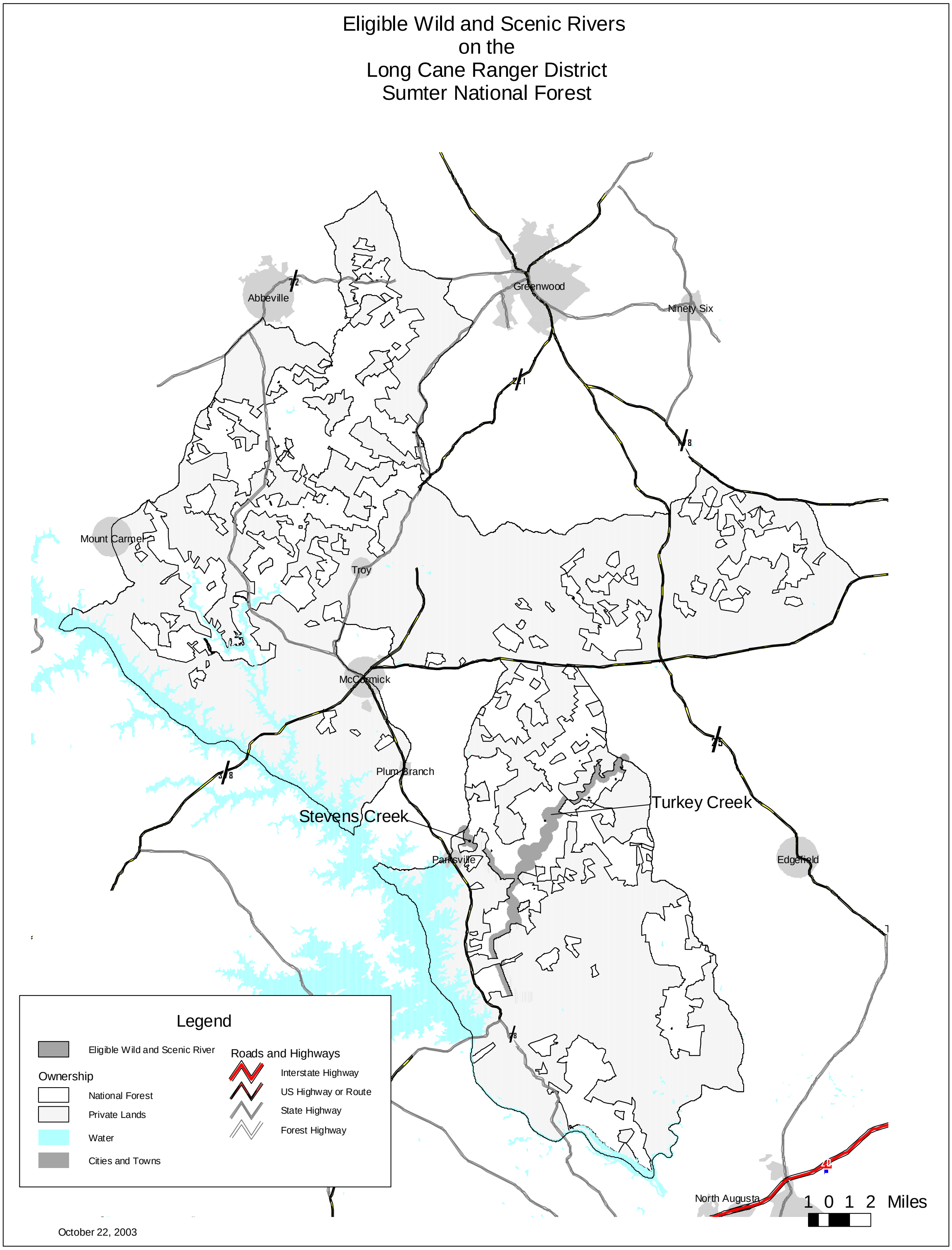
Table 3-104. Rivers Studied for National Wild and Scenic Rivers System and found ***Non-Eligible***

District	River	Miles
Tyger	Broad River	37
	Tyger River	30.2
	Enoree River	36.7
	Fairforest Creek	9.6
Andrew Pickens	Limber Pole Creek	2.0
	King Creek	3.2
	Crooked Creek	1.3
Long Cane	Little River	6.2
	Long Cane Creek	29.2

Table 3-105. Rivers Studied for Inclusion in National Wild and Scenic Rivers System and found ***Eligible***

District	River	Segment	Miles	Outstandingly Remarkable Value(s)	Preliminary Classification
Long Cane	Turkey	N/A	12.5	Wildlife Fish/Aquatic Botanical/Ecological	Scenic
	Stevens	N/A	13.4	Wildlife Botanical/Ecological	Recreational
Andrew Pickens	Brasstown Creek	N/A	3.9	Botanical/Ecological	Wild
	Cedar Creek	N/A	4.2	Botanical/Ecological	Scenic
	Chauga	I	7.9	Scenic Recreation Geologic Botanical/Ecological	Scenic
		II	4.1	Scenic Recreation Geologic Botanical/Ecological	Wild
		III	4.0	Scenic Recreation Geologic Botanical/Ecological	Scenic
	Crane	N/A	3.1	Fish/Aquatic	Scenic
	East Fork, Chattooga River	I	2.5	Fish/Aquatic	Recreational
		II	2.2	Fish/Aquatic	Wild
		III	.2	Fish/Aquatic Recreation	Recreational
		IV	2.4	Fish/Aquatic Recreation Botanical/Ecological	Wild
	Tamassee Creek	N/A	1.7	Botanical/Ecological	Wild


Eligible Wild and Scenic Rivers
on the
Andrew Pickens Ranger District
Sumter National Forest
East Fork of
Chattooga River
Crane Creek
Tamassee Creek
Salem
28
Chauga River
Cedar Creek
Walhalla
Brasstown Creek
Seneca
Westminster
Legend
Eligible Wild and Scenic River
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003



Eligible Wild and Scenic Rivers
on the
Long Cane Ranger District
Sumter National Forest
Abbeville
Greenwood
Ninety Six
Mount Carmel
Troy
McCormick
Plum Branch
Stevens Creek
Turkey Creek
Parksville
Edgefield
North Augusta
Legend
Eligible Wild and Scenic River
Ownership
National Forest
Private Lands
Water
Cities and Towns
Roads and Highways
Interstate Highway
US Highway or Route
State Highway
Forest Highway
1 0 1 2 Miles
October 22, 2003

Direct and Indirect Effects

Designated River (Chattooga River)

Please refer to Appendix H for the effects analysis related to whether or not to allow boating above Highway 28 on the Chattooga River. This appendix analyzes the effects of opening all or part of the Chattooga Wild and Scenic River above Highway 28 to whitewater boating. Opening up these sections of the river to boating was an issue raised during the public involvement processes for the Sumter Forest Plan Revision and Amendment 14 of the existing Sumter Plan.

Eligible Rivers

The identification of a river for study through the forest planning process does not trigger protection under the Act until designation by Congress. Importantly, identifying rivers as eligible, or eligible and suitable, does not create new agency authority; rather, it focuses the management actions within the discretion of the Forest Service on protecting identified river values. For eligible rivers, the preliminary (inventoried) classification is to be maintained, absent a suitability determination. The recommended classification is to be maintained throughout the duration of the forest plan. No river suitability studies are undertaken with this forest plan revision.

Under all alternatives, management emphasis for the eligible rivers and their corridors is focused on protection and enhancement of the values for which they were established, without limiting other uses that do not substantially interfere with public use and enjoyment of those values. The establishment values (outstandingly remarkable values) for the rivers on the Sumter National Forest include botanical/ecological, scenic, recreational, fisheries/aquatics and wildlife.

Effects of forest management on eligible rivers and their immediate surroundings are determined by the outstandingly remarkable values of the river, potential classifications of rivers, desired conditions of the area and existing conditions of the river.

In general, the free-flowing conditions and outstandingly remarkable values for the eligible rivers will be protected in all alternatives (for a list of the outstandingly remarkable values by river see Table 3-105). Alternatives do not vary in their potential classification of the eligible rivers (see Table 3-106).

Alternatives do vary in their allocation of the river and its immediate surroundings into different management prescriptions. Prescriptions for the river and its immediate surrounding include recommended wilderness, botanical areas, scenic areas, eligible river corridors, old-growth areas, dispersed recreation, scenic byway and high-quality timber products (See Table 3-107). These prescriptions may change the desired condition of some river corridors but would still protect or enhance the outstandingly remarkable values of the river (for a list of prescriptions by alternative see Table xx).

Effects on eligible rivers may come from management activities outside of the rivers immediate surroundings. Vegetation management, road construction, and construction or removal of recreation facilities could cause erosion along the river, visual intrusions and noise from nearby activities. Other management activities that also can affect the river resources are threatened and endangered (T&E) species habitat management, special use utility rights-of-way range management, recreation, administrative site facility construction, wildlife and fisheries management. Fire management within the area, prescribed fire and fire suppression actions, may result in smoke impacts, noise from aircraft, chainsaws, and engines, or lasting visual effects from charred vegetation. Search and rescue operations may cause some impact from the use of equipment in the river environs, but these are predicted to be minimal. Increased public interest and use may result in development of additional trailheads, trails, and access points to the river to accommodate additional public interest and use of the river. However, increased recreation use due to designation in the future may also result in more river related activities (boating, fishing, etc.) and cause localized increases in soil compaction and erosion of stream banks, and the need for limited public access. For a detailed list of probable activities by alternative see Appendix K.

Table 3-106 displays the number of miles of eligible river recommended by classification by alternative. Table 3-107 displays a list of prescriptions allocated to each river by alternative.

Table 3-106. Miles of Eligible River by Classification by Alternative

Classification	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F	Alt G	Alt I
Wild	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Scenic	31.7	31.7	31.7	31.7	31.7	31.7	31.7
Recreational	16.1	16.1	16.1	16.1	16.1	16.1	16.1

Table 3-107. Prescriptions Allocated to Eligible Rivers by Alternative

	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F	Alt G	Alt I
Prescrip-tions*	1B, 2B1, 2B2, 2B3, 4D, 5C,10B,12A	1B, 2B1, 2B2, 2B3, 4D, 5C	1B, 2B2, 2B3, 4D, 5C, 10B	1B, 2B1, 2B2, 2B3, 4D, 5C, 12A	1B, 4D, 4F, 5C, 7E1, 8A1, 10B, 11, 12A	1B, 2B1, 4F, 6B, 6D,	1B, 4D, 4F, 5C, 7A, 7E2, 8A1, 9G2, 10B

*SEE TABLE XX FOR DESCRIPTION OF MANAGEMENT PRESCRIPTIONS

Non-eligible Rivers

Management direction for non-eligible rivers is determined by the management prescription determined in the land and resource management plan. Rivers determined as not eligible may be managed on the Sumter National Forest under a variety of management prescriptions. These prescriptions will allow a wide variety of activities within the river corridor. Management activities may include road construction, vegetation management, insect and disease control, special use utility rights-of-way, and mineral extraction. Other management activities that also can affect the river resources to a lesser degree are threatened and endangered (T&E) species habitat management, military use, range management, recreation, administrative site facility construction, and wildlife and fisheries management. See alternative maps on pages 2-9 through 2-40 for the allocation of management prescriptions.

Suitable Rivers

No eligible rivers were analyzed for their suitable traits for inclusion in the National Wild and Scenic River System. (See Appendix D for an explanation of the eligibility process.) If the suitability study is not complete, then the outstandingly remarkable values of the eligible rivers will be maintained pending the suitability determination.

Recreation Related Programs Cumulative Effects

A discussion on cumulative effects of the alternatives presented in this EIS examines how social and land use trends on public and private lands in the Southern Appalachians together influence the healthy and sound management of national forest lands.

As discussed in the FEIS sections dealing with recreation and scenery, overall demand for outdoor recreation opportunities, and the settings that provide them, is increasing and it is increasing at a rate greater than population growth.

The demand for a particular type of recreation activity remains either stable with population growth, or increases more rapidly, depending on the activity. Generally, due to the aging population, the demand for less physically challenging activities, and therefore the demands for developed or improved settings, are likely to rise faster than demands for remote and primitive settings. (*Southern Appalachian Assessment Summary Report,* p. 37.)

Trends on private lands are relevant to Forest Service lands. Currently, public holdings represent one-third of the roaded natural-appearing settings and two-thirds of remote settings in the Southern Appalachians. These are the preferred settings for outdoor recreation experiences. Due to continuing development of roads and buildings, these settings on privately owned lands are being converted to rural forested settings.

(*Southern Appalachian Assessment Social/Cultural/Economic Technical Report*. pp.140, 157, 173.) The ability for the public to recreate on private lands is changing. About one-quarter of private landholders in the Southern Appalachians provide access for the recreating public for certain compatible activities. However, overtime, less private land is predicted to be available. (*Southern Forest Resource Assessment*, draft, Chapter Socio-6, pp. 2 and 12.)

Streams, rivers, and lakes draw people because of water's importance in high quality scenery and the recreation opportunities offered. Today, national forests are seeing congestion and overuse on many of its waterways. Use is exceeding capacity and public access provided by private lands to water for recreation is diminishing.

Therefore, a general trend on private lands surrounding the Sumter National Forest is the gradual loss of preferred settings for nature based recreation as well the potential to access private lands. Private lands are not expected to increase the supply for the settings preferred by outdoor recreationists for their activities. As a result, public lands will face most of the increasing recreation demand. (*Southern Forest Resource Assessment*, draft Chapter SOCIO-6.)

Related to recreation demand are tourism and its importance to gateway communities and regional economies. Many communities are encouraging tourism, which centers on using the attractions of national forests to stimulate their local economy.

Finally, nature-based settings are key ingredients for enhancing a sense of place in the Southern Appalachian and Piedmont communities. Rapid development of private lands in the South appears to be taking away the sense of place of long-term residents. Local communities identify with landscape features or have cultural practices related to natural settings. Also, traditional uses of the land by residents for hunting, fishing, and gathering of natural forest products have transferred in part to Forest Service lands as private lands become unavailable. Some conflicts may exist or may arise between long time residents and new development related to tourism and outdoor recreation. (*Southern Appalachian Assessment Summary Report*, pg. 38.)

The primary challenge for recreation managers is how to maintain the integrity of the ecosystems and high quality natural settings as more and more people bring more impact to the natural setting and want more and more conveniences. Alternatives A, E, and I emphasize increasing some developed recreation opportunities/facilities. Alternatives B, D, F, and G emphasize other values on national forest land and therefore provide a different range of recreation opportunities.

Regardless of the alternative selected, recreation demand is increasing and effects will occur. Effects, such as user conflict and resource impacts to riparian corridors, will simply show up sooner in alternatives that do not emphasize recreation opportunities. User controls will be needed, in varying degrees, to protect the health of the natural systems and to maintain an acceptable recreation experience. These controls will begin in current problem areas.

Regardless of alternative selected, it is unknown if future Forest Service budgets will be able to support the recreation staff, law enforcement, and facilities (whether for developed or dispersed settings) called for by recreation demand. This is particularly important for high maintenance and operational cost facilities or trail systems such as OHV areas where on-going maintenance and on-the-ground personnel are needed.

For those alternatives that generally emphasize recreation management, there will be a better opportunity to maintain scarce settings, provide high quality recreation experiences, and manage impacts on the land. Also, there will be a better opportunity to develop tourism linkages and partnerships to support local economies and sound recreation management programs.

Heritage Resources

Affected Environment

Approximately 12,000 years ago American Indians first occupied the area of South Carolina that is now part of the Sumter National Forest. Historic period tribal groups known to have lived in the area include the Cherokee and the Catawba. Archeological and historical research has been used to reconstruct and interpret Native American prehistory and the advance of Euro-American settlement into the upstate of South Carolina beginning in the 18th century. Land acquisition for a national forest in South Carolina began as early as 1914 as part of the Nantahala National Forest. The Sumter National Forest was created by Presidential proclamation in 1936.

More than 3,800 heritage resource sites are recorded on the Sumter National Forest. Prehistoric period sites include campsites, villages, hunting areas, stone tool quarrying areas, and petroglyphs. Historic period sites include farm houses, outbuildings, mines, dams, mills, quarries, cemeteries, churches, Revolutionary War battlefields, pottery and lime kilns, bridges, Civilian Conservation Corp camps and World War II POW camps, CCC recreational improvements, forest fire lookout towers, and improved springs. Numerous old trails, railroad beds, and abandoned roadbeds can be found on the forest.

These remnants of past cultures remind us of the centuries-old relationship between people and the land. These heritage resources hold clues to past ecosystems, add richness and depth to our landscapes, provide links to living traditions, and may lead the forest visitor into an unforgettable encounter with history. Prehistoric and historic heritage resources are nonrenewable and the purpose of the heritage management is to protect significant heritage resources, to share their values with the forest visitor, and to contribute relevant information and perspectives to forest management.

Direct and Indirect Effects

There are a number of types of land management activities that vary in magnitude (acres or miles), but nonetheless have the potential to affect heritage resources. These include timber management, road construction, fire management, recreation use, wildlife management, landownership adjustment (land exchange), special use authorizations, structures management, and minerals management.

Management activities that involve ground disturbance or modifications have the greatest potential for direct effects to heritage resources. These activities would include, but are not limited to, any soil disturbance such as the use of heavy equipment in harvesting, grading, plowing, disking, and excavating. Soil compaction or rutting by heavy equipment would also have a direct effect. Also, any activity that alters a site's immediate or proximal setting, for example, introduction of intrusive visual or auditory components, would have a direct effect. The removal of a site from public ownership through land exchange would have an effect.

Indirect effects to heritage resources may include looting or vandalism due to increased access, and site degradation or silting of a historic property resulting from an off-site project or construction of roads or trails.

Timber harvesting has the potential to directly affect heritage resources. Timber harvesting may directly affect heritage resources when soil is significantly disturbed by heavy machinery and vehicles, when trees are felled on historic ruins or cemeteries, when logs are skidded across sites, or indirectly when erosion is caused by removal or disruption of vegetation cover or increased surface soil exposure. In general terms, even-aged harvesting may affect heritage resources located on the ground surface or at relatively shallow depths. An uneven-aged harvest or single tree selection would similarly disturb the heritage resources located on the surface and in the upper soil matrix, but disturbed areas would be dispersed within the harvest area. With either management practice, the skid trails, log loading areas, and other areas where vehicle use is concentrated would receive the greatest disturbance and thus provide the most significant direct affects to heritage properties. Indirect affects could include deterioration of sites and artifacts from subsequent erosion and increased site vandalism from increased access and surface exposure of heritage sites.

The potential maximum direct, indirect, and cumulative effects to heritage resources located on the Sumter National Forest can be assessed according to the maximum extent (acres) within which ground-disturbing activities can potentially occur for each alternative. The principal proposed ground-disturbing activities include timber, recreation, fire, wildlife, and special use management. The acreage within which potential ground-disturbance, and concomitant effects to heritage resources, can occur is presented by prescription and alternative in Appendix K.

Alternative F provides the highest potential for timber management activities to affect heritage resources of all alternatives. Accordingly, the potential for timber management

to affect heritage resources is followed, in descending order, by Alternatives I, B, D, A, E, and G.

Legally mandated inventories for heritage resources would be conducted prior to timber harvest and subsequent site preparation under all alternatives. On the Sumter National Forest, site preparation following timber harvest, or vegetation management performed apart from timber harvest, is usually performed with the aid of heavy equipment. Site preparation activities, therefore, can result in significant direct, indirect, or cumulative effects to archaeological sites.

New road construction may directly affect heritage resources, given variables specific to each portion of construction. Disturbance within a construction corridor may remove soil containing cultural deposits, depending on the local situation. In cases where fill is added, archaeological sites may be buried deeper. This may protect the site from compaction or rutting, while at the same time essentially precluding additional scientific study using conventional archaeological techniques. Maintenance or reconstruction of existing roads presents less potential for direct effects to intact archeological sites because the majority of damage to an archaeological site probably occurred during the original construction. Access to heritage resources provided by roads, however, may result in indirect effects to significant properties by facilitating increased visitation and possibility of vandalism. Indirect effects also may include erosion of archaeological sites subsequent to road construction. Also, artifact exposure during construction could promote site vandalism.

The potential effects of road construction to heritage resources would be determined by the amount of acreage for timber management, recreation development, and other resource management activities proposed for each alternative. Accordingly, it can be projected that those alternatives that provide for the greatest number of activities over the largest area will have the greatest potential to affect heritage resources.

Heritage resources may be directly and indirectly affected by heat damage to artifacts and sites and erosion of sites resulting from wildfires or prescribed fires. High-temperature wildfire could pose direct effects to heritage resources by damaging surface or shallow archeological sites, standing structures, and cemetery markers. Sites of the historic period are most subject to direct effects from these events because many of these properties are more likely to exhibit surface artifacts. Studies show that wildfire and, in some cases higher temperature prescribed burns, may alter the character and condition of surface artifacts such as melting glass, “crazing” lithic and ceramic artifacts, and burning wood structures. Prescribed fire could similarly directly affect surface sites or very shallow site deposits and artifacts, but because of reduced temperature, to a much lesser degree than wildfire. However, wooden structures and cemetery markers could still be damaged, as could surface artifacts.

Fire lines, whether for wildfires or prescribed burns, could directly affect heritage resources. Fire lines constructed using either a bulldozer pulling a fire plow or using the front blade to push or scrape a line affect archaeological sites by physically displacing artifacts or damaging or destroying subsurface features. Fire line construction may

truncate the site by removing the upper portion while leaving the lower portion of the site relatively undisturbed. When multiple parallel fire lines are used for wildfire control, it would be possible to disturb or even destroy a large portion of a small site. Fire lines established using a disc harrow would have less impact than those made with a tractor plow or dozer blade. In these cases, lateral soil displacement would be minimal, but some fragile surface artifacts or artifacts and features located in shallow deposits may be broken or destroyed. Fires lines installed for prescribed burns are less likely to directly or indirectly affect heritage resources since proposed fire lines in areas of prescribed burns are inventoried for heritage resources prior to project implementation. However, heritage surveys usually do not precede emergency fire line construction. Thus, there is a high potential for heritage resources to be affected by activities associated with wildfire suppression. Indirect effects following the installation of fire lines and burning may include erosion losses due to the removal or burning of vegetation cover or further deterioration of artifact or feature condition following damage by high temperatures.

All of the alternatives propose to use prescribed burning and, therefore, have a potential to affect cultural resources. Alternative G, which proposes the fewest acres for prescribed burning, provides the least potential for a prescribed burning program to affect heritage resources of all alternatives. Alternatives E and B present the largest program of annual prescribed burning of all alternatives, and have the highest potential to affect heritage resources of all alternatives.

Recreation management may be one of three types: concentrated (formal recreation areas), dispersed recreation areas, and trails (off road vehicle trails, horse trails, and foot trails). In general, direct effects to cultural resources can result from construction of recreation facilities and expansion of recreation facilities and recreational areas. Indirect effects could include soil erosion and compaction of heritage resources due to visitor use, and access given to locales could result in archeological site vandalism. These indirect effects could especially occur with illegal expansions off established off-road vehicle trails.

The incidence of vandalism and illicit collection is very much influenced by visitor use. Greater visitor use to some areas will lead to the increase of vandalism, illicit collection, littering, and disturbance to cultural sites under all alternatives. Opening areas to timber production and timber manipulation, recreation use, and construction of roads and trails will result in an increase in site disturbance and vandalism in previously inaccessible areas that were previously naturally protected from direct, indirect, and cumulative effects. While heritage resources situated in recreation areas and along designated trails and road corridors can be signed, monitored, and patrolled, the impacts outside of these areas are largely uncontrolled and the extent of impact unknown. However, the Forest Service does have the authority to close a specific road, trail, or area that has considerable adverse effects to cultural resources (36 CFR 295.5, 36 CFR 800.9, and 43 CFR 8342) and prosecute, under 36 CFR 296.4 and other laws, those who willfully destroy or loot heritage resources.

All of the alternatives propose similar increases in the construction and maintenance of trails and facilities. Therefore, all of the alternatives have a potential to directly affect heritage resources during construction and maintenance and indirectly through the increase in forest users.

Exchange of federal land containing significant heritage resources to a non-federal agency or private ownership is considered a direct effect with no indirect or cumulative effects. This is because protection under federal laws and regulations would no longer apply to the heritage resources contained within a tract that is exchanged out of federal ownership.

Analysis of effects to significant cultural resources located on lands to be exchanged out of Forest Service ownership is performed programmatically in compliance with existing laws and regulations, for example 36 CFR 296, 800, and the Memorandum of Understanding (MOU) with the South Carolina State Historic Preservation Officer (SHPO), and occurs on a case-by-case basis apart from alternatives. As such, effects to heritage resources resulting from land exchanged out of federal jurisdiction are not affected by alternative.

Special use authorizations allow the use of national forest land by other agencies, individuals, organizations, or corporations. Direct effects to heritage resources located in special use areas may result from the activities of the permit holder. Limitations may be imposed upon special use permits for the purposes of resource protection. Indirect effects to heritage resources located in special use areas can occur through erosion and vandalism of heritage resources resulting from increased access and use of permit areas.

Analysis of effects to heritage resources located on lands placed under special use permit is performed programmatically in compliance with existing laws and regulations (36 CFR 296, 800, and the MOU with the SC SHPO) and occurs on a case-by-case basis apart from alternatives. As such, effects to heritage resources resulting from special use permits are not affected by alternative.

Historic mining facilities, mines, tailings, and exploration davits determined to be historically significant are protected and maintained under existing federal laws and regulations. Generally, activities associated with the exploration for minerals have the potential to directly affect heritage resources. Mineral extraction may produce severe, albeit localized, direct effects to cultural resources as the overburden containing historic resources are removed. Indirect effects could include damage to cultural resources located outside the area of immediate mining resulting from erosion, the installation of road accesses and equipment staging areas, and vandalism and looting resulting from increased access to these heritage resources.

Analysis of effects of minerals management to cultural resources is performed programmatically in compliance with existing laws and regulations (e.g., 36 CFR 296, 800, and the MOU with the South Carolina SHPO) and occurs on a case-by-case basis

separate from alternatives. Therefore, effects to heritage resources resulting from minerals management are not affected by alternative.

Structures located on the Sumter National Forest that are determined to be historically significant are protected and maintained under the terms and conditions of existing federal laws and regulations. The construction of new facilities or the maintenance of older structures and facilities could directly affect heritage resources. In most cases of concrete slab or footing construction, disturbance may extend into or below soil strata containing archeological deposits. Lighter facilities, such as boardwalks, piers, or structures located on pier foundations would present less potential for damage. The construction of structures could also directly affect heritage resources by introducing a visual affect that conflicts with or diminishes the setting and nature of an historic property. Maintenance of historic structures such as old work centers, picnic shelters, and fire lookouts could have direct effects on the historic property if not carried out in a manner compatible with the historic structure. Indirect effects could include erosion or vandalism of heritage resources facilitated by public access following construction of structures in the immediate vicinity.

Analysis of effects to historic structures, and the effects of the construction and maintenance of structures to heritage resources, is performed programmatically in compliance with existing laws and regulations (e.g., 36 CFR 296, 800, and the MOU with the South Carolina SHPO). As such, effects to heritage resources resulting from facilities construction and maintenance would be similar for each alternative

Areas in which wildlife food plots are traditionally installed are areas of high probability for containing heritage resources. The construction of new wildlife food plots has the greatest potential to directly affect heritage resources. To convert a forested area into an open field, heavy equipment may be used to clear trees and underbrush and to remove stumps. Maintenance of wildlife fields through a program of disking may directly affect cultural properties as well. Indirect effects could include vandalism of heritage resources located in wildlife plots by exposing sites to collection and looting.

The construction of new wildlife openings is proposed in all alternatives except Alternative G. The direct effects to heritage resources would be greatest in Alternative E, followed by Alternative F, then B, then Alternatives A, D, and I. Alternative G would have no effect on heritage resources. Maintenance of the existing system of wildlife plots is proposed for all of the alternatives and the effects to heritage resources would be similar for all alternatives.

Cumulative Effects

All of the proposed land management activities vary in magnitude and intensity, but nonetheless have the potential to affect heritage resources. Cumulatively, the repeated implementation of activities including timber management, road construction, fire management, recreation use, wildlife management, landownership adjustment (land

exchange), special use authorizations, structures management, and minerals management, could, over time, result in the degradation of heritage resources and a reduction in the number of intact heritage resources.

The degree of cumulative effects to heritage resources from all management activities could be greatly reduced through the implementation of heritage inventory, assessment, protection, and mitigation measures prior to the initiation of these management activities. Processes and actions not associated with land management activities, such as erosion, natural weathering, wildfire or other natural process, could affect heritage resources, too. Cumulative effects from illegal activities, primarily vandalism, may occur on certain sites unless actions are taken to prevent or discourage such activities through vigorous law enforcement and a program of public awareness concerning the nature of heritage resources on public lands.

Forest Products

Affected Environment

Nationally, the projected demand for wood products is expected to increase (RPA Timber Assessment, April 1, 2002). By the year 2050, U.S. consumption of forest products is projected to increase by 40%. This increased demand would be met by:

1. An increase in U.S. timber harvest of 23%.
2. An increase in log, chip, and product imports of 85%.
3. An increase in use of recovered paper of 85%.

With a near term economic recession, U.S. roundwood harvest is projected to decrease in the short-term, then increase.

Forest industry is a major contributor to South Carolina’s economy, having the third highest payroll and contributing $3.4 billion value added in 1997.

The primary wood products offered for sale from the Sumter National Forest are pine sawtimber and pulpwood. During the 1960s through the 1980s, average annual sale volumes were typically in the range of 10-15 MMCF. Table 3-108 displays the volume sold from 1986-2001. The first full year of implementation was1986 for the previous Sumter Land and Resource Management Plan.

Table 3-108. Timber Volumes sold on the Sumter NF from 1986 to 2001.

Year	Volume MMCF	Volume MMBF
1986	10.69	58.8
1987	11.36	62.5
1988	10.11	55.6
1989	9.88	54.4
1990	6.97	38.3
1991	8.18	45.0
1992	7.73	42.5
1993	8.10	44.6
1994	7.23	39.7
1995	6.41	35.3
1996	5.13	28.2
1997	5.44	29.9
1998	5.40	29.7
1999	4.34	23.9
2000	3.39	18.6
2001	2.81	15.5

The Forest Inventory and Analysis (FIA) section of the Southern Research Station remeasures permanent inventory plots across all ownerships in the southern states to provide large scale estimates of timber inventories and trends in the different states. There are approximately 94 FIA plots in the Sumter National Forest. Table 3-109 shows the estimated timber inventory, growth, and mortality from these plots:

Table 3-109. Timber inventory, growth and mortality for the Sumter National Forest, according to Forest Inventory and Analysis plots, South Carolina cycle 3 annual inventory, year 2000. All volumes are for trees >= 5.0" diameter at a height of 4.5'.

National Forest Acres	344,838
Volume (MMCF)	711
Net Annual Growth (MMCF)	15
Average Annual Mortality (MMCF)	16

The above acreage is approximately 5% lower than the known acreage of the Sumter National Forest at roughly 362,850 acres. Accordingly, the volume estimates above should be adjusted upward by 5%.

Since 1985, prices for all wood products except pine pulpwood have increased substantially. Table 3-110 shows the change in stumpage prices.

Table 3-110. Statewide average wood product prices for South Carolina, 1985 and 2002 (3rd quarter). Prices from Timber Mart-South.

	1985	2002, 3rd Quarter
Pine sawtimber, $/MBF Scribner	149	297
Pine pulpwood, $/cord	16.42	14.01
Hardwood sawtimber, $/MBF Doyle	53	130
Hardwood pulpwood, $/cord	3.00	15.83

Special forest products include various portions of commercial and non-commercial species of various plants, by-products of other forest operations, or are geological or mineral in nature. Since 1985, special forest products taken from the Sumter include: pine straw, cane poles, sawdust, soil, lighter wood, magnolia and dogwood limbs and leaves, cedar posts, Christmas trees, old barn lumber, pine bark, firewood, and boughs. Demand for these products is limited.

Direct and Indirect Effects

The timber resource is managed to provide a continuous flow of forest products and create a wide range of forest conditions, within the framework of sound silvicultural techniques. It is also one of the primary means of implementing many aspects of ecosystem management.

Designation of lands as suitable for timber production, and the allowable sale quantity (ASQ) that these lands can produce are selected to measure the effects of implementing the alternatives on the timber resource. ASQ describes the maximum volume of timber that may be harvested from lands suitable for timber production during a specified period, usually 10 years. This volume cannot be exceeded during a given decade, and it is not presented as a guaranteed harvest volume. The actual volume offered is the aggregate of individual project proposals, and is dependent on a number of factors including annual budgets and organizational capabilities.

ASQ and suitable acres respond to the various vegetation management strategies associated with achieving alternative goals, desired conditions, or objectives. The economic effects section of this document discusses the dollar returns of the harvest levels produced by the alternatives. Figure 3-11 shows the acres that each alternative designates as suitable for timber production.

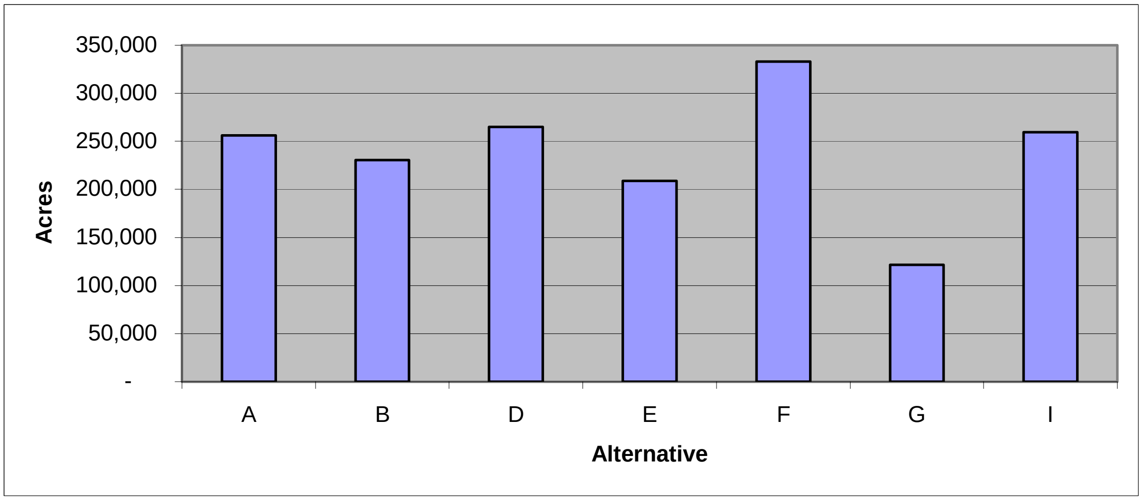


Figure 3-11. Acres Suitable for Timber Production by Alternative

Long-term sustained yield capacity (LTSYC) represents the highest yield of wood that may be sustained under a specified management emphasis. It also represents the volume of wood that may be managed while meeting all management requirements for protection of other resources. For each alternative, ASQ essentially equals the long-term sustained yield capacity (LTSYC) for the entire planning horizon, even the first decade.
This reflects the current condition of the forest, which gives numerous choices for harvest on suitable lands. Figure 3-12 displays LTSYC for each alternative. As one would expect, the levels of long-term sustained yield mirror the acreage that is suitable for timber production. The model used to estimate ASQ and LTSYC is not able to account for spatial relationships, such as adjacency. With an approximate 10-year order of entry, and the 5-year age after which regeneration harvest areas are no longer considered openings, adjacency should not present a problem. None of the alternatives would have the compartment level constraints that had limiting effects on implementation of the 1985 plan. Nor will the guidelines in the wildlife habitat management handbook be treated as standards as they were for the 1985 plan.

Figure 3-12. Long Term Sustained Yield Capacity by Alternative

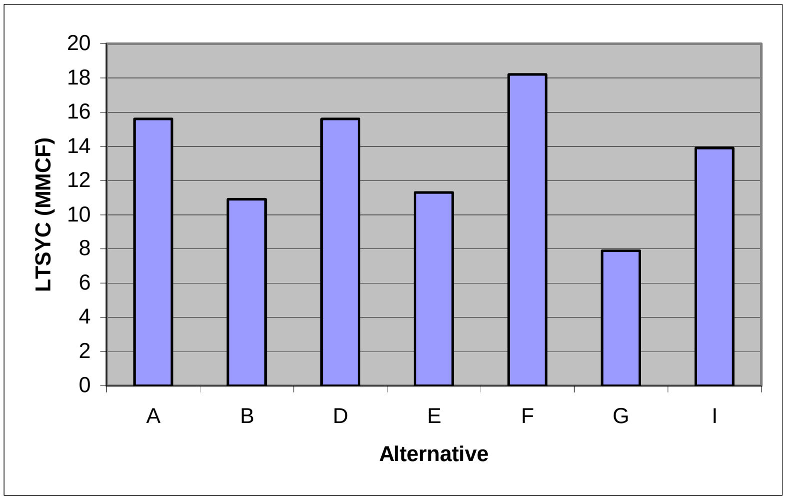


Table 3-111 displays the Allowable Sale Quantity by decade for each alternative.

Table 3-111. Allowable Sale Quantity in MMCF by Decade for Each Alternative.

	Alternative						
Decade	A	B	D	E	F	G	I
1	15.6	10.9	15.6	11.3	18.2	7.9	13.9
2	15.6	10.9	15.6	11.3	18.2	7.9	13.9
3	15.6	10.9	15.6	11.3	18.2	7.9	13.9
4	15.6	10.9	15.6	11.3	18.2	7.9	13.9
5	15.6	10.9	15.6	11.3	18.2	7.9	13.9
6	15.6	10.9	15.6	11.3	18.2	7.9	13.9
7	15.6	10.9	15.6	11.3	18.2	7.9	13.9
8	15.6	10.9	15.6	11.3	18.2	7.9	13.9
9	15.6	10.9	15.6	11.3	18.2	7.9	13.9
10	15.6	10.9	15.6	11.3	18.2	7.9	13.9

Table 3-112 displays the projected average annual net cash flow of the Sumter National Forest timber program.

Table 3-112. Projected Average Annual Net cash flow of Sumter NF Timber Program in Millions of Dollars by Alternative and Period, First 5 Decades, 1996 Dollars.

		Annual Average Within Each Decade Period				
Alt	Measure	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
A	Revenue	15.15	13.94	13.89	9.91	10.76
	Costs	2.46	3.52	3.30	3.01	2.80
	Net	12.69	10.42	10.59	6.90	7.96
B	Revenue	8.83	8.17	8.07	8.04	8.27
	Costs	1.06	1.64	1.66	1.46	1.58
	Net	7.77	6.53	6.41	6.58	6.69
D	Revenue	14.97	13.79	13.77	10.25	10.26
	Costs	2.27	3.61	3.33	3.17	2.81
	Net	12.70	10.18	10.44	7.08	7.45
E	Revenue	10.70	9.82	8.84	8.88	7.87
	Costs	1.52	2.12	1.97	1.65	1.89
	Net	9.18	7.70	6.87	7.23	5.98
F	Revenue	17.35	15.59	15.59	11.59	11.90
	Costs	2.95	3.83	3.96	3.62	3.22
	Net	14.40	11.76	11.63	7.97	8.68
G	Revenue	7.32	6.63	7.00	6.25	6.67
	Costs	1.06	1.34	1.40	1.31	1.41
	Net	6.26	5.29	5.60	4.94	5.26
I	Revenue	12.51	12.18	12.49	9.93	9.79
	Costs	1.80	2.77	2.90	2.62	2.51
	Net	10.71	9.41	9.59	7.31	7.28

Cumulative Effects

The Analysis of the Management Situation shows that the Sumter comprises about 3% of the timber supply and demand analysis area and 5% of the sawtimber inventory. Although the Sumter's role in the overall supply and demand picture is relatively small, it can be important to local loggers and mills. Soft prices for pulpwood may limit sales of small timber in some locations, but sawtimber prices are strong across the forest. The Sumter would be able to sell the quantities of sawtimber anticipated by any of the alternatives considered.

Lands and Special Uses

Affected Environment

The lands program includes:

- Acquiring, exchanging, and transferring forest land.
- Acquiring, granting and exchanging rights-of-way.
- Locating and maintaining property boundaries.
- Resolving land claims and trespasses.
- Processing and administering special use applications and authorizations.

The proclamation boundary of the Sumter National Forest encompasses 960,000 acres across 11 counties; however, only 364,000 of those acres are currently in national forest ownership. This equates to 38% of the land within the proclamation boundary is interspersed with privately-owned land. This intermingled ownership pattern causes some forest tracts to be inaccessible to the public and difficult to manage. Additional acres are needed to meet expected resource outputs (water, wildlife, threatened and endangered species, timber, recreation, wilderness and range). Between 1992 and 2002, approximately 7,521 acres have been added to the Sumter National Forest and 885 acres have been conveyed to private parties through purchases or land exchanges. Priority for acquisition or exchange is decided on a case-by-case basis in accordance with guidelines established in a Land Ownership Adjustment Strategy (LOAS). A LOAS will guide a planned, coordinated program for acquiring and adjusting necessary interests in land to optimize public benefits and administrative effectiveness of the forest, consistent with congressional direction and budget authorizations.

The national forest property boundaries total approximately 1,750 miles. Most of these boundaries have been located and marked, but maintenance of the lines remains a challenge. There are a number of title claims, encroachments, and trespasses.

The fragmented ownership pattern creates a need for legal access to isolated tracts of land. Rights-of-way acquisition is an ongoing part of the lands program, and is critical for management of the forest as well as to connect the public with National Forest System lands.

There are currently 231 special use authorizations covering 4,746 acres on the Sumter National Forest. Most authorizations are for road easements or permits. The Long Mountain Communications Site on the Andrew Pickens Ranger District is the only designated communications site on the forest. Guided raft trips on the Chattooga River are authorized under special use permits and represent a significant part of the outfitter/guide program. Other authorized uses include utilities, wells, cemeteries, communication uses, reservoirs, agriculture, churches, experimental or research areas, outfitters and guides, and oil and gas pipelines. About 20 new proposals for

authorizations exceeding one year are received annually for these types of uses. Numerous requests for authorizations less than one year are received every year.

Direct, Indirect and Cumulative Effects

The probable activities under all alternatives will have little to no effect on the current land adjustment program, since most of the activities occur under the current plan. The mixed ownership pattern will continue to provide opportunities for land adjustment through exchange, purchase, donation, and rights-of-way acquisition. In all alternatives the positive effects of an active land adjustment program could include protection of federally listed threatened and endangered species, congressionally designated areas, riparian ecosystems, environmentally sensitive areas, administrative sites, significant historical and cultural resources, and view-sheds for recreational pursuits. A potential negative effect of land acquisition is due to concerns from some individuals and government officials that acquisition of additional federal land will reduce the acres available for the property tax base and limit development potential for private enterprise.

Maintenance of property lines on a regular rotation will allow for effective land management, and a reduction of encroachments and title claims will be an added benefit.

Under all the alternatives, rights-of-way will continue to be acquired to secure legal access to allow for the use and enjoyment of the national forest by the public now and in the future.

Most special use authorizations are incompatible with wilderness and wilderness study areas and are eliminated by existing laws and regulations. The preferred alternative recommends the least number of acres for wilderness study, therefore would limit special use authorizations the least of all the alternatives. Special use proposals will continue to be processed and new and existing authorizations administered in accordance with Forest Service missions, policies, and regulations under all the alternatives. There will be minor differences between the various alternatives in the limitations and mitigation measures imposed on proposed special use authorizations in order to achieve the desired conditions described in the management prescriptions.

Prescribed and Wildland Fire

Affected Environment

Fire is a natural ecological process, but unlike the others (tornadoes, floods, hurricanes, etc.) humans have the capability to use fire as a tool and, as recent history has shown, to suppress the natural processes of fire. And by doing so, humans have most certainly changed the landscape and effects of fire once present. We must now consider the consequences of all our management decisions, and weigh suppression versus wildland fire use if we are to adequately manage the ecosystems entrusted to us.

Ecosystem sustainability has been defined as the capacity to maintain ecosystem health, productivity, diversity, and overall integrity, in the context of human activity and use. In the current Federal Wildland Fire Management Policy (2001), fire management and ecosystem sustainability is second only to firefighter and public safety. Fire management and ecosystem sustainability are described as “the full range of fire management activities being used to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social components.”

“An important goal of ecosystem management is to retain structural and functional components across the landscape consistent with the capabilities of the ecosystem.” (Swanson et.al. 1973) The role fire plays is complicated because it influences and controls many ecosystem processes and characteristics. The many roles of fire include influences and alterations: plant species composition and community type, succession, scale of vegetation mosaic, fuel accumulations, dry matter and nutrient cycles and energy flows, wildlife habitat, interaction with insect and disease, ecosystem productivity, diversity, and stability. The concept of fire regimes can help us categorize the many-faceted role of fire. Knowledge of fire regimes is increasingly recognized as a critical basis for ecosystem management.

“Fire regime” refers to the nature of fire occurring over long periods and the prominent immediate effects of fire that generally characterize an ecosystem (Brown 2002). Classifications of fire regimes can be based on the characteristics of the fire (frequency, periodicity, intensity, size, pattern, etc.) or on the effects produced by the fire. Heinselman (1978) first introduced fire regimes based on a classification of fire intensity (crowning or surface fire), size of ecologically significant fires, and fire frequency or return interval. Kilgore (1981) modified Heinselman’s fire regimes by relating fire intensity to fire severity when referring to mortality of the primary tree cover as stand replacement. More recent fire regimes by Morgan and others (1998) used fire severity and fire frequency to establish four fire severity and five fire frequency classes.

The National Fire Plan, *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems A Cohesive Strategy (2000),* combines fire frequency, expressed as fire return interval, and fire severity established by Hardy and others (1998). The five historic natural fire regime groups are:

- Group 1 – (0 to 35 years) low severity.
- Group 2 – (0 to 35 years) stand replacement severity.
- Group 3 – (35 to 100+ years) mixed severity.
- Group 4 – (35 to 100+ years) stand replacement severity.
- Group 5 – (more than 200 years) stands replacement severity.

Using fire severity as a key component in describing fire regimes is appealing because it relates to direct or primary fire effects disturbance, which concerns ecosystem management. The classification of fire severity, and thus fire regimes, is based on the

effects from fire on the dominant vegetation. The following describes the fire regimes used in *Flora and Fuel Volume* (Brown 2000):

- Understory fire regime (applies to forests and woodlands): Fires are generally nonlethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. Approximately 80% or more of the above-ground vegetation survives fires.
- Stand-replacement fire regime (applies to forests, woodlands, shrublands, and grasslands): Fires kill above-ground parts of the dominant vegetation, changing the above-ground structure substantially. Approximately 80% or more of the dominant vegetation is either consumed or dies as a result of fires.
- Mixed severity fire regime (applies to forests and woodlands): Severity of fire either causes selective mortality in dominant vegetation, depending on different tree species' susceptibility to fire, or varies between understory and stand-replacement.
- Nonfire regimes: Little or no occurrence of natural fire.

Historical human intervention (suppression, timber harvesting, grazing, and other past management activities), natural disasters such as Hurricane Hugo, insect and disease, and the reduction of landscape burning have resulted in fire regimes that are far from "historical norms." The greatest effects of human intervention have been on short fire-interval ecosystems, where fires occur every 10 years or so. By contrast, longer fire-interval ecosystems, 100 years or more, are probably not as affected, and have less chance for unnatural fuel accumulations and changes in forest structure. In low intensity fire regimes, fire exclusion has allowed shifts in species composition, often from fire tolerant to intolerant species.

Departure from historical fire regimes to current conditions has been described as condition classes in the National Fire Plan, *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy* (2000). "Current condition is defined in terms of departure from the historic fire regimes, as determined by the number of missed fire return intervals – with respect to the historic fire return interval – and the current structure and composition of the system resulting from alterations to the disturbance regime." As condition class increases, so does the relative risk of fire-caused losses of key components defining the system. Key components include: species composition, structural stage, stand age, and canopy closure. The fire condition class as a measure of general wildland fire risk and ecosystem condition are defined as follows:

- **Condition Class 1:** For the most part, fire regimes in this fire condition class are within historical ranges. Vegetation composition and structure are intact. Fire dependent ecosystem components are maintained by desired fire regimes. Thus, the risk of losing key ecosystem components from the occurrence of wildland fire remains relatively low.

- **Condition Class 2:** Fire regimes on these lands have been moderately altered from their historical range. A moderate risk of losing key ecosystem components

has been identified on these lands. Fire frequencies have departed by one or more return intervals. Vegetation composition has been moderately altered.

- **<u>Condition Class 3:</u>** Fire regimes on these lands have been significantly altered from their historical return interval. The risk of losing key ecosystem components from fire is high. Fire frequencies have departed from historical ranges by multiple return intervals. Vegetation composition, structure, and diversity have been significantly altered. Consequently, these lands verge on the greatest risk of ecological collapse.

The National Fire Plan, *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy*, and subsequently the *10-Year Comprehensive Strategy*, outline an approach to management of wildland fire, hazardous fuels, and fire dependent ecosystem restoration and maintenance. The focus on treating hazardous fuels is to reduce the risk of unplanned and unwanted fire to communities and the environment. Performance measures from the *10-Year Comprehensive Strategy* are focused on moving the number of acres in fire regimes 1, 2, or 3 to better (lower risk) condition classes, while treating in order of priority those acres in the wildland urban interface (WUI), then those areas in condition class 2 or 3 in fire regimes 1,2 ,or 3 outside the WUI.

With changes in forest structure and accumulating fuels comes the increased risk of catastrophic fire. Catastrophic fire can have devastating effects environmentally, socially, and economically. As more and more people build within or near these fuel build-ups, the risk of catastrophic loss from wildland fire becomes a matter of when rather than if.

According to the 2001 Federal Wildland Fire Management Policy, response to wildland fire is based on ecological, social, and legal consequences of the fire. Consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate management response. Often, the values to be protected include wildland urban interface (WUI). Wildland urban interface is defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. This often drives suppression rather than fire use for ecosystem benefit.

Fire managers must continually consider:

- Ecosystems are always changing. Fire is a major agent of that change.
- Fire suppression has a place in fire management.
- Fire exclusion has environmental and economic consequences.
- Using prescribed fire to meet ecosystem objectives results in social tradeoffs.

Background

Fire behavior and its effects vary within the Sumter National Forest. The piedmont is characterized by gently rolling hills. Fires here, though sometimes numerous, are usually small. Steeper, longer slopes characterize the mountains, and affect fire behavior and fire size more dramatically than the topography found on the piedmont. Consequently, the mountains have the potential for larger fires.

The Sumter National Forest is dominated by fire-adapted and fire-dependent ecosystems. Most of the forest is characterized by short return interval (<35 years) understory fire regimes with low to moderate intensity ground fires that generally are non-lethal to the dominant trees. The piedmont and mountains consist of a combination of 0-10 and 0–35 years fire return interval communities. Stand replacement fires may occur within these regimes due to such things as topography, time of year, fuel conditions, weather conditions during a fire, or drought, etc.

The Sumter National Forest suppresses an average of 30 wildland fires annually, which burn approximately 200 acres of national forest land. Ninety percent of these fires are human caused, with most being caused by incendiary and escaped debris burning. Ten percent of the fires are caused by lightning. Eighty-six percent of the fires were 10 acres or less.

The forest may expect 40-50 days of high fire danger and one day of very high to extreme fire danger, annually. Most fires occur during the high fire danger periods with flame lengths of 3-5 feet. Severe and extreme droughts occur periodically, usually beginning in the spring and may continue through November. During these periods the Keetch-Byrum Drought Index may reach 700+. In the past 25 years, the Sumter has had 17 escape fires (over 100 acres), an annual escape fire frequency of 0.68 and an average of 234 acres burned per year.

The current fire management program has resulted in an average of nine fires per 100,000 acres protected with 0.05% of the forest burned annually.

Many factors influence the complexity of wildland fire management on the Sumter, particularly as it relates to ecosystem management. Two primary factors are forest fuels and wildland urban interface. Major factors affecting forest fuels are dominant vegetation type and age (overstory, midstory and ground cover) and presence of insect and disease. Clearcutting over the past 20 years has resulted in a mosaic of 0 to 20 year-old pine stands. Fires starting in reproduction are harder to suppress than open stands with light fuels, have a greater potential of increased mortality to adjacent overstory, and increase the potential for crownfire and stand replacing fires. A recent infestation of the Southern Pine Beetle has dramatically increased the amount of fuel present, both on the ground and standing. This in turn has increased the available fuel present, potentially increasing both fire behavior and effects. Currently 38% of the Sumter is being treated for the Southern Pine Beetle. Treatments include salvage sales in the piedmont and cut-

and-leave activities in the mountains and piedmont. Both types of treatment will increase hazardous fuels on the ground, and add complexity and hazard to suppression efforts and wildland fire use.

The dispersed ownership pattern of the forest positions wildlands and private structures in juxtaposition. Much of the forest can be classified as wildland urban interface. This wildland urban interface places the private structures at increased risk from wildland fires and vice versa. The hazardous fuels reduction program strives to reduce this risk.

The hazardous fuels reduction program focuses on treating the fuels hazard in condition classes 2 & 3 and bringing into condition class 1, with priority in the wildland urban interface. Fuels reduction is accomplished primarily using prescribed fire or mechanical methods, but other methods may be used, such as chemical or animal. The current prescribed burning program for hazardous fuel treatments and resource management treats about 20,000 acres annually. Approximately 18,000 acres of the average are burned for hazardous fuels reduction and 2,000 acres for other resources management.

The significance of the wildland urban interface increases as the populations in these areas increase – the upstate of South Carolina is a population growth area. People are attracted to living in the wildland setting for many different reasons. As human development and recreation use impinge upon these fire regimes, increased ignition risks and concern for protecting economic values will substantially affect fire management activities in these areas. If suppression continues, and fire is excluded from these areas, fuel loadings will increase, resulting in increasingly greater risk for larger and more intense fires. Ecosystem management and forest health concerns are expected to increase the role of management-ignited and wildland fire use in the future.

Fire dependent ecosystems on the Sumter National Forest fall into nine vegetation community types and only one fire regime. There are six primary, significant size, and three secondary, insignificant size, community types. However, three primary communities (shortleaf pine-oak, shortleaf/pitch pine, and shortleaf pine/loblolly pine) have been combined into the shortleaf pine/pitch pine/pine-oak for ease of analysis, since we are primarily concerned with fire effects and fire return interval. All three secondary community types will be omitted from this section analysis, because of their insignificant size and the overlap with another section. Table 3-113 displays current community types and corresponding fire return intervals on the Sumter, for forested lands only.

Table 3-113. Current community types and corresponding fire return intervals on the Sumter NF.

Community Type	Fire return interval (years)	Total Acres	Percent of Forest	Fire Regime
Dry-Mesic Oak	10-35	52251	14.80 %	Understory t To Mixed
Dry and Xeric Oak	3-10	12142	3.44 %	**Understory**
Shortleaf Pine/Pitch Pine/Pine-Oak (all mixed types)	2-10	29286	8.29 %	Understory
Loblolly Pine-Oak (Dry & Dry-Mesic Oak-Pine in part)	10-35	213707	60.52 %	Understory
Table Mountain Pine (Pine & Pine-Oak in Part)	10-35	33	0.01 %	Stand-replacement
Mountain Longleaf Pine (Pine & Pine-Oak in Part)	6-10	74	0.02 %	Understory
Grass Dominated communities	2-10	146	0.04 %	Stand-replacement
Not Fire Dependent	-----	45493	12.88 %	

Note: Some communities could have been broken down even further; however, since we are concerned with fire effects and fire return interval, they were combined for ease of analysis.

The shortest return interval of 2-10 years represents a total of 12% of the Sumter. The remaining fire dependent ecosystem has a return interval of 10-35 years and represents 75% of the Sumter.

The short fire return interval on the Sumter reflects an understory fire regime, or group 1 fire regime. This is a fire-maintained ecosystem in which light or low intensity fires reduce the occurrence of destructive wildland fire through thinning and pruning. Fires of low to moderate intensity also remove dead and downed surface fuels before they build up, reducing the risk of severe or high-intensity fire. Vegetation or plant communities within this fire regime demonstrate adaptations that maintain or preserve the individual species following repeated fire occurrence. As stands approach higher ends of the fire return interval, a more mixed result from fire can and would be expected. If fire is excluded, the health, composition, and diversity of the plant community can be quickly altered, and stand-replacement fire is expected. Fire dependent ecosystems with this short return fire interval, 10 years or so, change structure quickly in the absence of fire, becoming increasingly unstable. This fire regime represents 87% of the Sumter.

Table 3-114 displays the desired acreage in condition class 1 for fire-dependent communities.

Condition class is a measure of general wildland fire risk and ecosystem condition.

Table 3-114. Desired acreage in Condition Class 1 for fire-dependent communities on the Sumter National Forest 10 and 50 years following adoption of plan revision. (Based on Alternative I)

Community Type	10-year Condition Class 1 Objective	50-year Condition Class 1 Objective	Fire return interval (years)
Dry-Mesic Oak	33979	50592	10-35
Dry and Xeric Oak	9613	12120	3-10
Shortleaf Pine/Pitch Pine/ Pine-Oak (all mixed types)	23945	28877	2-10
Loblolly Pine-Oak (Dry & Dry-Mesic Oak-Pine in part)	181555	207852	10-35

These acreages represent first approximations of objectives related to acres of fire-dependent communities restored and maintained in condition class 1. These objectives are essential in managing our fire dependent ecosystems for ecosystem sustainability and protecting our communities from the threat of catastrophic wildland fire. Details on how these objectives would be achieved will be covered in forest-level fire management plans.

In order to obtain the above 10-year and 50-year condition class 1 objectives on the Sumter, the following annual acreage as shown in Table 3-115 would be necessary under Alternative I.

Table 3-115. Annual acreage by Condition Class 1

BURN PROGRAM	10-year Condition Class 1 Objective	50-year Condition Class 1 Objective
Low end	9514	11484
Mid point	23122	27903
High end	36730	44323

These acreages are unconstrained by budget, environmental, and agency restrictions, and only include prescribed fire acres related to fire dependant communities listed in Table 3-114 above, and condition class 1 objectives. As previously mentioned, grass dominated, mountain longleaf and Table Mountain pine acres were not included in this section, since they are in the Terrestrial Habitats section.

Direct and Indirect Effects

Management activities and natural processes affect fire and its environment, commonly known as the fire environment. In order for a fire to burn it needs three things: heat (ignition), fuel, and oxygen. Management activities affect all three of these components, while manipulation of forest vegetation and fuels has the greatest influence. It is

important to remember that activities in alternatives will differentially affect the fire environment; for example, reducing road density will decrease access and lower the risk of human-caused ignition, but will increase response time and effort allowing the fire to grow in size. Management activities affect the fire environment, influence the amount of wildland fire, and influence the need for or ability to use fire, either management ignited fire or wildland fire use.

Risk of Wildland Fire (Ignition Source)

The primary ignition source for fires on the Sumter is arson. As human activities increase, the potential for ignition increases as well. Access into and throughout the forest, whether motorized or not, will increase the risk of arson fire.

Alternative G will pose the least risk for arson fire to occur, while alternative A will create the greatest potential risk. Table 3-116 displays the miles of non-motorized and motorized access for a 10-year period.

Table 3-116. Motorized and Non-motorized Access, for 10 year period.

		ALT F (current)	ALT A	ALT B	ALT D	ALT E	ALT G	ALT I
Non-Motorized Trails	Miles	220	435	220	220	435	220	385
Motorized Trails	Miles	46	106	46	46	106	46	86
Road Construction / Reconstruction	Miles	368	315	224	284	255	172	298
TOTAL MOTORIZED ACCESS	Miles	414	421	270	330	361	218	384
TOTAL ACCESS	Miles	634	856	490	550	796	438	769

Motorized and non-motorized roads and trails increase human activity on the forest and result in an increased risk of wildland fires from arson. Motorized vehicles pose an additional risk of ignition from vehicles.

Decommissioning roads can reduce human access and the risk of human-ignition sources. The amount of road closures by alternative was consistent at 7 miles per year.

As recreation user density increases human activity on the forest, the risk of human-caused ignition increases. Campfires are a common source of wildland fires across the National Forest System. Dispersed sites pose a greater risk of escaped campfires than do developed recreation sites. Alternatives A and D are the only alternatives maintaining or constructing developed recreation sites.

Active timber harvest activities increase the risk of ignition from increased human activity and machinery. These effects were not considered significant since provisions within the contract mitigate them.

Fuels

Fire, like many processes, depends on certain conditions to exist. Whether or not a fire burns and how it behaves is dependant on fuels, weather, and topography. While we cannot readily change weather or topography, we have a tremendous impact on fuels. Management activities change fuel characteristics and influence fire behavior, affecting: horizontal and vertical arrangement (both live and dead fuels), loading, moisture, and temperature.

Although dispersed and developed recreation temporarily rearrange fuels which may burn during a fire, generally reducing risk of damaging fire to the site by decreasing fuel loads, they also increase ignition risk from humans. The overall result would be a negligible effect on fuels.

On the other hand, timber harvest activities affect fuel conditions more than any other management activity. Timber harvesting temporarily increases fuel loads from slash and activity fuels, depending on utilization of cut material. However, this temporary fuel increase and arrangement is mitigated in administration of the timber sale contract and provisions contained within. Contract provisions that require reduction or removal of slash mitigate activity fuels.

The general increase in fuel loads immediately following a timber harvest results in an increased risk of destructive wildland fire due to increasing fire intensity and rates or spread, making fires more difficult to control. These effects usually diminish within a few years as logging slash decays and deteriorates. Site preparation activities such as: handfelling, herbicides, and drum chopping will mitigate activity fuels from even-aged regeneration activities in all the alternatives. In general, the long-term benefits are reduced natural fuel loadings and a breakup in fuel continuity, resulting in decreased fire intensity, reduced risk of catastrophic fire, and fires that are easier to control. Harvest prescriptions which reduce canopy closure and stems per acre also reduce the potential for crown fires that are independent of surface fire. Table 3-117 displays the amount and type of harvest by alternative, for the 10-year period.

Table 3-117 displays the amount and type of harvest by alternative, for the 10 year period.

		ALT F (current)	ALT A	ALT B	ALT D	ALT E	ALT G	ALT I
Even-Aged Regeneration	Acres	45060	39050	16110	35110	23390	16140	31910
Thinning	Acres	30000	20000	50000	20620	26450	20000	22430
Stand Improvement	Acres	47590	32610	5310	35540	18580	10180	26850
TOTAL	Acres	122650	91660	71420	91270	68420	46320	81190
PERCENT Forest treated		43	32	24	32	24	16	28

Even-aged regeneration, thinning and stand improvement activities reduce ladder fuels, crown density, and over-all fuel loads, decreasing crown fire potential and mortality from fire. Alternative F treats the most forested acres with these harvest activities, followed closely by Alternatives A, D, I, B, and E respectively.

Even-aged regeneration, thinning and stand improvement activity acreages, are lowest in Alternative G. This alternative has the greatest potential for increasing fire intensity and tree mortality from stand replacement fire due to accumulating dead and ladder fuels. This in effect limits appropriate management response to suppression, greatly reducing the chance of using naturally ignited fire for resource benefit. Accumulating fuels and increased crownfire potential also result in conditions where firefighter safety is reduced without additional mitigation.

Suppression

The factors listed above influence fuels and thus fire behavior. Fire behavior (intensity, rate of spread, spotting and crowning, etc.) is a major concern to fire managers as it affects appropriate management response (suppression tactics versus wildland fire use), safety, fire size, and resource benefit or loss from fire. Restrictions on suppression tactics can decrease firefighter and public safety, and increase behavior and fire size. While it is important to allow natural processes to take place when and where appropriate, these restrictions need to be addressed.

The following table represents the number of acres in each suppression type by alternative (Table 3-118). Restricted suppression refers to management areas with limitations on suppression activities, which confines the scope of appropriate

management response by restricting the use of some suppression resources. Severely restricted suppression refers to those areas where limitations on suppression activities are most restricted, resulting in the most confined appropriate management response option and fewest suppression resource options. Unrestricted suppression refers to areas with no restrictions or limitations placed on suppression resources. Table 3-118 displays the suppression changes by alternative.

Table 3-118. Suppression changes by alternative:

Alternative	Suppression Unrestricted		**Suppression Restricted**		**Severely Restricted**	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**
F (current)	357403	98.5	424	0.1	5133	1.4
a) A	289459	79.9	62126	17.2	10490	2.9
B	278374	80.4	57746	16.7	9920	2.9
D	294505	81.6	61578	17.1	4960	1.4
E	291804	80.8	61200	17.0	7938	2.2
G	289436	80.4	61340	17.0	9148	2.5
I	286708	80.7	64240	18.1	4236	1.2

Alternative F had the greatest unrestricted area, allowing the most productive suppression methods to exist in the greatest percent of the forest. Suppression resources are able to use the most efficient resources in more of the forest under Alternative F. This should keep unwanted fires in this alternative the smallest, thus resulting in the least risk to resources and public.

As was discussed previously, activities differentially affect the fire environment. Although Alternative A has the greatest potential for human caused ignition of wildland fires because it increases the total mileage of non-motorized and motorized trails and roads, it will also improve response times and effectiveness in suppression efforts, compared with the other alternatives. In addition, roads and trails also redistribute fuels, limiting the spread of wildland fire and act as fire barriers by serving as control lines for wildland fire control.

Risk to Wildland Urban Interface (RX Fire) or Risk to Resources Loss and WUI

Management ignited fire, or prescribed burning, is an important tool for mitigating negative impacts on fuels and ignition risk caused by management activities. Prescribed burning, more than any other management activity, has the greatest effect on reducing risk of destructive wildland fires. It reduces fuel loads, reduces fire intensity, increases fire control efficiency, and results in less resource damage when a wildland fire occurs. Most importantly, it offers the fire manager more options for appropriate management response to wildland fire, especially concerning wildland fire use for resource benefit.

Table 3-119 displays the estimated annual prescribed fire condition class 1 objectives by alternative, for the 10-year period.

Table 3-119. Estimated annual prescribed fire condition class 1 objectives by alternative, for the 10 year period.

	Alternative F (current)	Alternative A	Alternative B	Alternative D	Alternative E	Alternative G	Alternative I
Low end	11500	9640	7669	10011	9444	4411	9514
Mid point	27869	23349	18660	24301	22962	10818	23122
High end	44238	37058	29650	38591	36479	17224	36730

Alternative F allows for the greatest acres of prescribed burning in order to meet 10-year condition class objectives for ecosystem management in the Sumter fire regimes. Alternatives A, D, E, and I have relatively the same effective burning acreage. Conversely, Alternative G allows for the least amount of management-ignited fire for ecosystem restoration.

"Fire spreads as a continually propagating process, not as a moving mass. Unlike a flash flood or an avalanche where a mass engulfs objects in its path, fire spreads because the locations along the path meet the requirements for combustion." (Cohen 2000). Wildland fire does not spread to homes unless fuels are present to carry fire to the homes and the homes meet fuel and heat requirements sufficient for ignition and continued combustion. Removing hazardous fuels near homes in the wildland urban interface and building homes with fire resistant materials reduces the risk of ignition and combustion of the homes. Since we do not govern structural building materials in the WUI, we must concentrate on reducing hazardous fuels in their proximity, in order to reduce the risk of loss from a wildland fire.

According to the National Fire Plan, management-ignited fire will focus on treating hazardous fuels to reduce risk of unplanned and unwanted fires to communities and the environment, with priority given to wildland urban interface and then those in condition class 2 or 3. Specific details on meeting burn objectives will be contained in the Forest Fire Management Plan. Based on prescribed fire acreages being treated, Alternative F presents the highest potential to reduce hazardous fuels, restore fire dependant ecosystems, and decrease risk of catastrophic wildland fire to WUI. Alternatives A, D, E, and I allow for a considerable amount of fire in the ecosystem, but neither the most nor the least. Alternative G presents the highest risk to WUI due to untreated fuels in fire-dependent ecosystems.

General

Alternative F treats the most acreage by either prescribed burning or timber activities, in turn reducing potential negative effects from wildland fire. This alternative rates in the mid-range for potential risk of human-caused ignition due to increased access, but has the greatest percentage of unrestricted suppression area. Alternative F reduces the risk of negative effects of wildland fire more than all other alternatives.

Alternative G treats the fewest acres of both timber and prescribed fire, increasing the risk of catastrophic fire. This alternative has the least amount of trail and road access and the lowest potential of human-caused ignition.

Alternatives A, D, and I treat nearly the same amount of forested acres by either prescribed burning or timber. Though these alternatives do not allow for as many acres of fuel reduction or ecosystem management, they are better than any of the other alternatives from a fire management perspective.

Alternatives B and E rank just above Alternative G for the number of acres treated by either prescribed fire or timber management.

Infrastructure (Roads and Access)

Affected Environment

Access to the Sumter National Forest requires a transportation network suitable for the needs of the public as well as the commercial interests. This network includes the federal, state, county, and private access roads along with the Forest Service road system. The network currently totals 2660.4 miles of which 1052.9 are under Forest Service jurisdiction (see Table 3-120). The extensive state and county road network provides the primary access into the forest. The forest road system provides the final access to points of interest and to administer, manage, and protect the public lands and resources.

Many of the Forest Service system roads are within corridors that have existed for many years. An extensive system of developed and primitive roads was in place when the lands were acquired. Although past Forest Service road development activities have been mainly to meet timber resource demands, the resulting system provides a broad range of access and levels of service to all users and visitors to the forest. Nearly all arterial and collector forest system roads are in place on the forest. The improvement and upgrading of these higher-level forest roads to meet current vehicle use would be an integral part of the proposed public forest service road program.

Table 3-120. Transportation Jurisdiction

TRANSPORTATION JURISDICTION					
	Functional Classification (MILES)				
Jurisdiction	Arterial	Collector	Local	Total	Percent
State/Federal	737.5	572.3	59.5	1369.3	51.5
County		107.1	122.9	230.0	8.7
Private			8.2	8.2	0.3
Forest Service	28.0	100.9	924.0	1052.9	39.5
Total Miles	765.5	780.3	1114.6	2660.4	100
% By Functional Class	28.8	29.3	41.9	100	

Forest management objectives for the road system are to operate the minimum network of roads that provide for user safety first with convenience and the efficient accomplishment of the forest's land and resource management objectives. Roads in the forest system are classified using a number of characteristics. The network status is classified by the designation of a road as arterial, collector, or local (see Transportation Jurisdiction Table 3-1). Arterial roads are through-roads that generally connect to a state or county road. Connector roads funnel traffic to arterial roads from blocks of forestland. Local roads serve limited areas or sites and generally connect with collector roads. The forest currently has jurisdiction to improve, maintain, and control approximately 40% of the roads and most of these are in the local category.

Forest Service roads are planned and maintained based on a road management objective. Road management objectives consider the vehicle type, traffic safety, cost of transportation, and impacts to land and resources. Traffic service levels are defined for each road to characterize the degree of service the road will offer and the type vehicles expected to use the road (Table 3-121). A major component of the traffic service level is the road surface material. The road system surfacing distribution is shown in Table 3-122.

Table 3-121. Traffic Service Levels

Traffic Service Levels (Miles)				
A	B	C	D	Total
-	64.9	677.1	310.9	1052.9

Table 3-122. Road Surfacing Types

Road Surfacing Types (Miles)				
Paved	Gravel	Improved	Native	Total
5.7	731.2	96.2	219.8	1052.9

National forest roads are maintained to assure planned service levels and user safety are preserved and that impacts to soil and water resources are kept to a minimum. Each road in the system is assigned a road maintenance level based on the road's management objectives. Roads in maintenance level 1 are closed to vehicular traffic and receive only custodial care to protect resources. Maintenance level 2 roads are generally for high clearance vehicles and are unsuitable for cars. Maintenance level 3,4, and 5 roads receive routine work to assure a safe, efficient and travelable road. The forest maintains the system mainly through service contracts but does some construction contracts for more extensive restoration work. The forest currently is able to do some level of maintenance annually on only 80% of the system roads due to budget limitations. The forest maintains less than 40% of the system to the current road management objective level. The maintenance level distribution of roads on the forest is displayed in Table 3-123.

Table 3-123. Operational Maintenance Level

Operational Maintenance Level

Level		Miles
1		399.6
2		43.8
3		506.3
4		97.9
5		5.3
	Total	1052.9

The forest has a close working relationship with many of the counties containing national forest land. Road cooperative agreements for the development, maintenance, and operation of selected roads of mutual interest are in place with the counties. Certain roads under state or county jurisdiction, which serve the mutual transportation needs of the public and forest, are designated as forest highways. These designated roads are eligible for Federal Highway Administration rehabilitation and reconstruction funding, including bridge replacement. Currently the forest has 412.64 miles of designated forest highways.

Commercial use of forest development roads is prohibited without a road use permit or authorization. Commercial users are responsible for their commensurate share of road maintenance either through deposits or performing the actual maintenance work.

Future Management

The development, management, and operation of the forest road system would continue as needed to respond to public use and resource management objectives. Any road determined to be needed, as a permanent facility would require periodic improvements and maintenance activities. Existing road cooperative agreements would be maintained and improved to continue participation with other agencies or local governments in accomplishing work on roads of mutual benefit. However, annual road maintenance is expected to continue to fall short of all of the system needs.

The forest's arterial and collector road needs are generally in place. These roads would require extensive restoration and improvement to assure they meet the continuing transportation demands of forest traffic. Existing local roads would continue to be managed to meet the demand for limited and intermittent access. Roads causing adverse impacts to the adjacent environment would be relocated where possible, stabilized to mitigate the effects, or decommissioned. In areas where current access does not exist, minimum design-standard roads would be planned with full public participation prior to

construction. Bridges and large drainage structures would continue to be inspected to meet national inspection requirements. Depending on funding availability, these structures would be rehabilitated, replaced, or closed as required to maintain user safety. Recreation facility road requirements would be planned, reconstructed, or constructed to meet the traffic vehicle and user demands.

The forest road maintenance appropriated funding has not kept pace with the increased contract and administration costs. Greater mileage of the system may be placed in the lower maintenance levels with even more road miles closed to vehicular traffic. Road management decisions would be accompanied by a "road analysis process" for the area under consideration in any decision document.

All roads would continue to be inventoried and scheduled condition surveys conducted. Decisions would be made about the intended continued use of a road. Based on the desired future condition, certain roads may be decommissioned and obliterated, closed for only intermittent use, or restricted to use during certain periods. Road decommissioning would continue to eliminate both system and non-system roads that are no longer required.

Traffic management methods would be applied to roads according to their intended use and to insure the safety of the user. These methods would incorporate road closure devices, orders restricting or prohibiting use, signing, and law enforcement.

Direct, Indirect and Cumulative Effects

The forest transportation system provides access to the forest for administrative management, hunting, fishing, timber harvest, sight seeing, and numerous other activities. Most Forest Service road development and operation activities will be associated with the local forest system roads. Roads – in particular new construction and reconstruction— have a multitude of direct, indirect, and cumulative effects on nearly all environmental components. Travel restrictions and road decommissioning may occur on the transportation system within certain areas of the forest to protect soil and water resources, reduce wildlife disturbance during certain seasons, and resolve user conflicts. Table 3-124 displays the effects for the first period of all the alternatives on road management.

Table 3-124. Effects of Alternatives on Transportation Management for Period 1

Effects of Alternatives on Transportation Management for Period 1								
Indicator Roads	Unit of Measure	Alt. A	Alt. B	Alt. D	Alt. E	Alt. F	Alt. G	Alt. I
Constructed	Miles/Yr	0.8	1.0	0.8	0.7	1.1	0.5	0.9
Reconstructed	Miles/Yr	34.0	39.3	31.9	28.9	43.4	21.7	34.2
Total	Miles/Yr	34.8	40.3	32.7	29.6	44.5	22.2	35.1
Maintained	Miles/Yr	845.0	835.0	845.0	835.0	835.0	835.0	845.0
Decommissioned	Miles/Yr	7.0	7.0	7.0	7.0	7.0	7.0	7.0

Effects of Recreation on Transportation Management

Travel, whether by car, OHV, horse, or by foot is fundamental to the enjoyment of the national forest. Recreation travel by car is the fastest growing segment of forest traffic. The forest recreation strategy of emphasizing our dispersed opportunities would only cause this segment to increase more on our forest. Recreation traffic volumes create a demand for generally higher standard roads -- for example, double lane or wider single lane, accommodation of higher travel speeds, smoother roadway surfaces, or greater visibility.

The recreation strategy of emphasizing the dispersed nature of the forest would have significant impacts on Alternatives A, D, E, and I. Driving for pleasure would continue to generate the highest traffic and create a demand for a higher standard, well-maintained road. The greatest impact on roads may come from hunting traffic during the big game seasons of fall and winter. The impact to maintenance during this wet season use from road rutting and surfacing loss into ditches can be significant. Public demand for a quality hunting experience also creates demands to open or close roads to motor vehicles depending on the type of hunt and time of year.

Recreation use can be expected to continue to increase over time in most categories. The developed recreation facilities would only see expansion in Alternatives A and D. This minor increase in capacity would have little effect on the forest transportation system in comparison to the effects of dispersed recreation traffic. The developed facilities would continue to require that a number of roads be reconstructed and improved to meet traffic and vehicle demands. Projected budgets, based on current allocations, would not be adequate to meet many of these needs.

The potential for crowding, user conflicts, and reduction in the quality of the experience would increase with more recreation demand. These demands could cause the roads to

require more restoration work rather than maintenance. Recreation would require a certain number of roads be reconstructed and maintained to a higher standard in all alternatives.

Effects of Soil and Water on Transportation Management

Soil properties and topography vary a lot among the many different geographic locations on the forest. These factors have a tremendous effect on the location, design, maintenance, and operation of roads on the forest. The climatic conditions in relation to the period of heaviest usage have a direct impact on the soil and water effects from the roads.

The high clay and mica contents of some soils on the Enoree and Long Cane Ranger Districts create less stable roadbeds and ditches. These soils require higher standard roads for such resource activities as timber harvesting and hunting. The roads would need more reconstruction and maintenance to prevent excess soil movement. Maintenance activities can also create soil movement by grading out the fine material to the surface. These fines are then subject to action from rain to wash into the roadside ditches.

The impacts from all alternatives would be less than the current management situation due to the reduction in harvest acres. The impact would be highest from construction and reconstruction under Alternatives B, F, and I. The impact from road maintenance would be significant under Alternative E due to increased recreation traffic.

Sound design, construction, and reconstruction practices can partially mitigate the effects on soils from roads. Avoiding locations of poor soils, slope and ditch stabilization, and surface stabilization can reduce impacts to soils from roads. The proposed public forest road program would reduce some of the highest deferred maintenance backlog needs on the forest effecting soil and water concerns.

Effects of Vegetation Management on Transportation Management

Timber harvesting activities would require road construction and reconstruction under all alternatives for all periods (Table 3-5, Effects of Alternatives on Transportation Management for Period 1). The miles of road impacted generally increases from period 1 to period 2. Alternatives B, F, and I would have the highest projected impact on the road system in period 1. This work would have both direct and indirect effects to the transportation system.

Past timber harvest acres were used to develop a roadwork coefficient to estimate the miles of construction and reconstruction. This coefficient, based on more even-aged management, may not have allocated significant miles due to the new emphasis on uneven-age management. The actual miles of construction and reconstruction would be

determined by the available acres for harvest and a site-specific analysis. The higher acres for uneven-aged management harvest in Alternatives B, F, and I may require some increase in road mileage development and maintenance.

Timber hauling produces observable physical effects on roads. Numerous trips by heavy log trucks create wear on the road subgrade and surfacing. These impacts can also affect soil and water by causing soil movement into roadside ditches. This wear and erosion can lead to roadbed failures creating the need to reconstruct the road.

Timber harvesting also has an indirect affect on forest roads. Larger haul volumes or longer hauling distances require more cooperative road maintenance fund collections. This results in the forest's increased ability to maintain more road miles to standard. All alternatives project a decrease in the first period from current levels, which would require more appropriated funding to maintain the current road management level. This reduction in funding may require limiting maintenance or access to some areas.

Vegetation management in road right-of-way is a critical factor due to climatic conditions on the forest. The type, species and especially the amount of vegetation are critical in maintaining the safety of the traveling public. The improper maintenance of vegetation can lead to the acceleration of erosion along roadway slopes and ditches.

The emphasis on protection of threatened and sensitive plants and planting of native species is increasing the cost of road maintenance and restoration work. The timing or elimination of some ditch maintenance work is having only minor effects on the environment. The requirement to eliminate invasive species and plant more native species may in time reduce the cost of some vegetation management practices. The alternatives with the most roadwork would see the heaviest impact from vegetation manipulation.

Effects of Wildlife on Transportation Management

Wildlife management has a heavy impact on the forest road system. These impacts are both positive and negative. The impact from hunting on road maintenance is due to the heavy use during the wettest part of the year. The impact from Alternative E would affect roads the most due to the emphasis on recreation.

The planting of closed roads for wildlife openings would help maintain the roadbed during long periods of nonuse. Protection of some species during nesting season would require the closure of some roads, reducing road maintenance costs. Protection of species may also require limiting of maintenance activities that could adversely affect road and ditch stability.

SOCIAL AND ECONOMIC ENVIRONMENT

Affected Environment

The Sumter National Forest includes approximately 362,000 acres of National Forest System land in the mountains and piedmont of South Carolina. The Forest is divided into three ranger districts located in 11 counties. The Andrew Pickens district is located in western Oconee County. The Enoree District is located east of Interstate 26 in Chester, Fairfield, Laurens, Newberry and Union Counties. The Lone Cane District lies east of J. Strom Thurmond Lake in Abbeville, Edgefield, Greenwood, McCormick and Saluda Counties.

The USDA Forest Service along with many other federal areas completed a broad assessment of this region in 1996, known as the Southern Appalachian Assessment (SAA). One of the components of this analysis is the “Social, Cultural, and Economic Technical Report”, where a social and economic assessment of the southern Appalachian lands was performed. The following assessment of the Sumter National Forest is tied to some of the more significant SAA findings. An attempt is made to contrast the Forests’s environment with similar findings from the southern Appalachian lands. The following SAA topics will be presented in this forest’s assessment:

I. Demographic (social) Changes
II. Economy Trends
III. Demographic Changes Effect on Natural Resource Management
IV. Impact of Natural Resource Management on the Economic and Social Status of Local Communities
V. Influence of Publics Outside Southern Appalachia and their Effect on Management of Ecosystems and Public Land
VI. Values and Attitudes of Southern Appalachia Residents Toward Natural Resources and Ecosystem Management
VII. Priorities for Management of Private Land by Non-industrial Owners

Social attitudes, values and beliefs are elements used to describe and understand the human dimension of resource management. This information is used to predict possible effects on local communities. These effects may include acceptance of or resistance to the decisions made. Social analysis coupled with economic demographic information forms the human dimension of ecosystem management. This information is used with the biological and physical analysis to best understand potential effects on the land as well as the human environment.

Demographic Changes

Past population growth and various racial and ethnic components of the population within the counties which comprise a national forest are characteristics of an area used to determine how dynamic and subject to change it may be in the future. A static area generally implies fewer possible issues and conflicts for land managers to consider. Conversely, a dynamic growing population or changes in population characteristics may produce many conflicting issues for consideration. Certain areas of the National Forest System and surrounding lands may be very attractive for second homes or retirement home residences. This attraction to urban dwellers in the surrounding communities may produce issues which conflict with traditional residents of the area.

Demographic changes for the Analysis area (Sumter National Forest boundary counties) and the Southern Appalachian Region Assessment (SAA) are presented first in the analysis. Then a contrast is made between the SAA region, the Forest and the State in which the Forest resides. Many of the time frames used in the Assessment were not available for the Forest, and more current data than 1990 were not available in the Assessment. Therefore, direct comparisons between the two are not always possible. Some limited 2000 Census data is available from the SF 1 count (mostly population, households and housing data from the “short form”). To the extent available these data are used in the analysis.

The Sumter NF analysis area is all eleven counties that have any Sumter NF system lands within its boundaries. Reference to the Forest or the Forest area in this report relates to the eleven-county study area unless specifically stated otherwise,

Population increased by 7.3 percent from 1980 to 1990 in the Southern Appalachian region. This compares with 8.1 percent for the Sumter NF, and 11.7 percent for the state in which the forest resides. More currently, the change from 1990 to 2000 was 12.4 and 11.5 percent, respectively. Tables 1-5 in Appendix I show population characteristics and their rates of change for each county within the Forest proclamation boundary, while Table 3-125 illustrates significant population variable changes from 1980 to 1990, and 1990 to estimated 2000 values on all the counties within the NF boundary.

Table 3-125. Minority Representation and Percent Populateion Change

MINORITY REPRESENTATION AND PERCENT POPULATION CHANGE				
	1990 % Minority	**Population % change '80-'90**	**2000 % Minority**	**Population % change 1990-2000**
Forest Counties	31.7	8.1	32.4	12.4
South Carolina	30.9	11.7	32.8	11.5
SAA	8.1	7.3	*	*

* No SAA number for 2000

Source: U.S. Census Bureau

Minorities made up approximately one-third of population within the Forest area and at the state level in 1980. The minority population continued to represent about 30-33% of the total in 1990 and 2000. Opportunities for forest visits by minorities has been very substantive since the 1970's, but has not changed much through time. The minority population in the SAA was lower than for the Forest counties or South Carolina, with 8.1 percent in 1990.

Population density in the SAA and the State of South Carolina was 102 and 116 persons per square mile, respectively, in 1990 (see Table 3-126). This was nearly twice the number of persons per square mile in the Forest area which had a density of 60. A decade earlier the same general relationship existed with densities of 94, 104 and 55 for the SAA, State and Forest, respectively. In 2000 the State and Forest density had increased about 12 percent to 133 and 67 but the relationship of the State which was nearly double the Forest density in 1980 did not change.

Table 3-126. Population Density

POPULATION DENSITY			
	1980 Population Density Persons/Sq. Mile	**1990 Population Density Persons/Sq. mile**	**2000 Population Density Person/Sq. Mile**
Forest Counties	55.3	59.8	67.3
South Carolina	103.6	115.8	133.2
SAA	94	102	*

* No SAA number for 2000

Source: U.S. Census Bureau

The Forest and State are very similar in their minority representation and have a much higher representation of minorities than the larger SAA. The Forest, however, deviates substantially from the SAA and the State of South Carolina, with regards to population density. This is due to the absence of large metropolitan areas in the Forest area. This divergence can be expected to continue in the near future.

The low population density for the Forest is consistent with the rural representation of the population in the Forest county boundaries relative to the State and SAA. The percentage of persons living in rural areas in Forest counties was 68.5 percent in 1980 and increased to 72.5 percent in 1990 (see Table 3-127). This is in contrast to the lower percentage of approximately 45 percent for the State in both 1980 and 1990. The SAA had a rural character with 53.0 percent classified as rural in 1990, which was greater than South Carolina, but much less rural representation than for the Forest. All Forest counties reflected a strong majority rural population in both 1980 and 1990 (see Table 6 of the Appendix I). One county, McCormick, was shown to have 100 percent rural population in 1980 and 1990.

Table 3-127. Rural Representation

RURAL REPRESENTATION		
	1980 % Rural	**1990 % Rural**
Forest Counties	68.5	72.5
South Carolina	45.9	45.4
SAA	*	53.0

* No SAA number for 1980

Source: U.S. Census Bureau

All Forest counties had a rural representation of 65 percent or more in 1990. Greenwood County had the lowest rural representation (65.1%) in the Forest analysis area and also had the highest population density, being nearly double the Forest county average (see table 5 of the Appendix I).

The Sumter NF analysis area exhibited some population growth in the decade of the 1980's and this growth trend grew stronger in the 1990's. Growth was in both rural and urban areas, but appears to slightly favor the rural area at least in the decade of the 1980's. Union County is the only Sumter NF analysis area county that did not reflect a positive population growth trend. McCormick County, which was 100 percent rural, grew much faster than the average analysis area county in the 1980's and matched the average county growth trend of the 1990's.

Per capita income is a relative measure of the wealth of an area. It constitutes the personal income from all sources divided by the population of the area. In the Forest

analysis area 1990 per capita income averaged $10,191 compared to $11,897 in the State of South Carolina and $10,950 in the SAA (see Table 3-128).

Table 3-128. Per Capita Income

PER CAPITA INCOME			
	1980 Per Capita Income	**1990 Per Capita Income**	**Real Avg. Annual % Change '80-'90 Per Capita Income**
South Carolina	$5,884	$11,897	2.4
Forest Counties Avg.	$5,230	$10,191	2.1
SAA	$6,377	$10,950	0.8

Source: U.S. Census Bureau

Income for both the Forest area and South Carolina grew faster on a real basis (inflation adjusted) than the SAA during the 1980's. The Sumter NF grew at a 2.1 percent annual rate, compared to a slightly faster rate of 2.4 for the State and a much slower, 0.8, rate in the SAA. All individual counties in the Forest had positive per capita growth rates ranging from 1.2 to 3.5 percent (see table 7 of Appendix I).

Table 11 of the Appendix I summarizes income data for the Forest and State based on Bureau of Economic Analysis (BEA) measurements. This data is per capita personal income, which is not directly comparable with the Bureau of the Census per capita income data shown in Table 7 of Appendix I. The two data sets differ because Census data is obtained directly from households, whereas the BEA income series is estimated largely on the basis of data from administrative records of business and governmental sources. The definitions of income are, also, different. Caution must also be used in comparing growth rates of Table 7 with Table 11 because growth in Table 7 is based on real or inflation adjusted dollars while growth in Table 11 is based on nominal dollars (unadjusted for inflation).

The Sumter NF can be characterized as a relatively poorer area than the State of South Carolina or the SAA. The growth rate during the 1980's left the Forest further behind when compared to the State but showed substantial gains compared to the SAA. Information for 2000 was not available, but the continuation of these growth trends in the 1990's would result in the Forest reaching comparability with the SAA by the year 2000.

The percent of the workforce out of work is another indicator of relative economic prosperity. Unemployment rates change dramatically over time, depending in large part on the national and regional economy. Some areas, however, have protracted unemployment problems because of educational attainment and lack of skills.

In 1990 the Forest had an unemployment rate of 6.1 percent (see Table 3-129), a higher rate than for the State (4.7%), but slightly less than existed in the SAA (6.5%). The unemployment rate for the Forest in 1997 was 5.4 percent and, again, was nearly one percentage point above the statewide rate. More resolution in unemployment rates for the Forest by county can be found in Table 7 of the Appendix I for 1980 and 1990 and in Table 12 of the Appendix I for 1997.

Table 3-129. Unemployment Rate

UNEMPLOYMENT RATE		
	1990 Unemployment % Rate	**1997 Unemployment % Rate**
Forest Counties	6.1	5.4
South Carolina	4.7	4.5
SAA	6.5	*

* No SAA number for 1997

Source: U.S. Census Bureau

Percent of people living in poverty is another population characteristic which provides an indicator of relative economic prosperity of an area. A substantial number of persons in the Forest area are classified as living in poverty. This statistic was 16.3 percent in 1989 and 16.4 percent in 1995 (see Table 3-130). The data for South Carolina was slightly lower, 15.7 percent in 1989 and 15.4 percent in 1995. Data for the SAA is only available for 1989, but reflects a much lower rate of 11.0 percent. Information for individual Forest boundary counties is presented in Appendix I Table 8 and presents a wide range between counties from 11-23 percent. Counties on the high end of the range in 1995 were also on the high end of the range in 1989 indicating that this is a persistent characteristic of the Forest area.

Table 3-130. Poverty Rate

POVERTY RATE		
	1989—Percent of People of All Ages in Poverty	**1995—Percent of People of All Ages in Poverty**
Forest Counties	16.3	16.4
South Carolina	15.7	15.4
SAA	11.0	*

* No SAA number for 1995

Source: U.S. Census Bureau

The percent of households headed by a female member can be a factor that contributes to relative poverty and relates to social disunity for an area (see Table 3-131). The greater this percentage is, the higher the number of households that may be on some form of government assistance.

Table 3-131. Percent of Female Head of Households

PERCENT OF FEMALE HEAD OF HOUSEHOLDS		
	1980 Female Head of Households	**1990 Female Head of Households**
Forest Counties	6.2	7.5
South Carolina	6.9	7.5
SAA	*	10.5

* No SAA number for 1980

Source: U.S. Census Bureau

Female-headed households increased substantially in the 1980-90 decade at the Forest and State level. The Forest had a lower level of female head of households in 1980 (6.2%), but increased to the same level as the State of South Carolina by 1990 (7.5%). Both the Forest and the State were substantially below the 1990 level of 10.5 % for the SAA.

The number of persons per household in the decade of the 1980's and in the 1990's was very similar between the Forest and the State (see Table 3-132). The trend was for decreasing household size; declining from 3.0 persons in 1980 to 2.5 persons in 2000. Information for the SAA was only available for 1990, but the Forest and State were very comparable to this larger area at that time.

Table 3-132. Household Density

HOUSEHOLD DENSITY			
	1980 Persons per Household	**1990 Persons per Household**	**2000 Persons per Household**
Forest Counties	3.0	2.7	2.5
South Carolina	2.9	2.7	2.5
SAA	*	2.6	*

* No SAA number for 1980 and 2000

Source: U.S. Census Bureau

The decade of the 1970's reflected substantial growth in housing units at both the Forest and State levels (see Table 3-133). This trend continued at a slower pace in the 1980's

and then picked up again some in the 1990's, but not equal to the growth rate of the 1970's decade. The three statistics population growth, housing density and housing units are directly related. In the 1990's Forest population increased 12.4 percent (presented above) and persons per household declined from 2.7 to 2.5. This would imply that the number of housing units increased faster than population growth. This seems to be the case as seen in the table below which shows a 21.7 percent growth in the 1990 decade while population increased 12.4 percent. Growth rates for housing in the Forest area substantially trailed that of the State through the decade of the 1970's and 1980's. In the 1990's the growth rate of the Forest area was only 1.4 percent behind the State.

Table 3-133. Housing Units

HOUSING UNITS			
	Housing Units Percent Change	**Housing Units Percent Change**	**Housing units Percent Change**
	1970-80	**1980-90**	**1990-00**
Forest Counties	26.9	16.7	21.7
South Carolina	41.5	23.5	23.1

Source: U.S. Census Bureau

Median housing values for the three areas are contrasted in Table 3-134. Housing values in the Sumter NF are substantially below the values for the SAA and the State of South Carolina. Housing values are determined principally by the extent of demand. The greater the demand, the higher prices are bid up. Population and job increases play a factor in the extent of demand for housing. Another factor is land and building costs. Land cost in the more rural Forest setting would generally be less than in a more urban area. The median value of housing on the Forest was $27,555 in 1980 and increased to $46,236 in 1990. The comparable values for South Carolina were $35,100 and $61,100. The values for the SAA were less than the State but higher than the Forest. Information by individual Forest area Counties is shown in Appendix I Table 10.

Table 3-134. Housing Value

HOUSING VALUE		
	Housing Units Median Value 1980	**Housing Units Median Value 1990**
Forest Counties	$27,555	$36,236
South Carolina	$35,100	$61,100
SAA	*	$59,700

No SAA number for 1980

Source: U.S. Census Bureau

Economy Trends

Analyzing the major sectors of an economy allows insight into how diverse the economy is and what industries may be driving its growth (see Table 3-135). Table 13 of the Appendix I shows the entire economy broken out by major Standard Industrial Code (SIC) industries and by important industry sub-sectors for wood products and for an estimate of the contribution of certain industries to tourism. Table 13 shows the nine major one digit SIC's in bold print.

Table 3-135. Economic Diversity.

ECONOMIC DIVERSITY				
	Industry Output		**Employment**	
Sector	**% of Total 1985**	**% of Total 1996**	**% of Total 1985**	**% of Total 1996**
Manufacturing	56.6	54.0	41.9	33.5
Lumber & Wood Prods.	2.8	3.4	2.5	2.2
Wood Furn. & Fixtures	0.0	0.1	0.0	0.1
Paper & Pulp Prods.	0.3	0.2	0.2	0.1
Total Tourism	0.8	0.7	1.4	1.7
Total Economy*	$8,652.3	$14,907.4	139,366	175,568

* Dollars in Millions and number of employees

Source: IMPLAN Data, 1985 and 1996

Manufacturing is a dominate sector in the Forest economy, but declined in importance between 1985 and 1996 with respect to both industrial output and employment. This sector represented 54 percent of industrial output and 33.5 percent of the Forest area employment in 1996. As the manufacturing sector declined other sectors have expand thereby making the economy more diverse.

The larger SAA economy had 42 percent of industrial output associated with manufacturing in 1991. This reflects a slightly more diverse economy than existed in the Forest area. Both the SAA and the Forest have a concentration in manufacturing much higher than the 20 percent level of the U.S. economy as a whole.

Within the manufacturing sector, wood and wood-related products (lumber, furniture & fixtures and pulp & paper) represented 3.7 percent of the local economy's total output in 1996. This was a small increase over the 3.1 percent wood and wood-related products represented in 1985. Employment in the wood and wood-related sub-sectors was essentially unchanged at about 2.5 percent in 1985 and 1996.

Tourism is defined as any non business- related travel of 100 miles or more from home. Recreation would be a subset of the tourism estimate; therefore, its share of the economy would be something less than the tourism numbers. Recreation in a local rural area is a major part of the tourism estimate and presents the best estimate of the importance of recreation available.

The estimate of tourism's share of the economy was about the same for output in 1985 and 1996. Employment, however, increased from 1.4 percent in 1985 to 1.7 percent in 1996. Further comparison of all nine sectors of the Sumter NF analysis area economy is presented in Table 13 of the Appendix I.

Besides the manufacturing changes discussed above, other changes include construction increase from 4.1 percent of output in 1985 to 6.1 percent in 1996; finance, insurance and real estate increase from 3.9 percent to 5.5 percent and the services sector, non tourism related, increase from 5.4 percent to 7.5 percent in 1996. Agriculture and wholesale and retail trade sector, non-tourism related, were two sectors that reflected slight declines between 1985 and 1996. With these changes the local economy is becoming more diverse, but remains heavily reliant on the manufacturing sector for a major part of the economic activity.

For the purpose of economic analysis, in the Southern Appalachian Assessment, the years of contrast were 1977 and 1991 from the IMPLAN input-output model (see Table 3-136). In the Forest analysis more current data were used, which contrasts a 1985 regional economy with the one found in 1996. Because these years are dissimilar, many of the percentage changes are not directly comparable. Determining an average annual rate of change for both data sets does allow for a relative comparison measure. The following chart compares the rate of change between the SAA's economy and the Sumter NF analysis area.

Table 3-136. Economy Dynamics

ECONOMY DYNAMICS		
	Employment Avg. Annual % Change	**Industrial output Avg. Annual % Change**
Forest Counties*	2.1	5.1
SAA**	1.9	2.6

* Change from 1985 to 1996

** Change from 1977 to 1991

Source: IMPLAN 1985 and 1996 Data

The average annual growth in industrial output in the Forest area (5.1%) is nearly twice the growth rate for SAA (2.6%). Change in employment in Sumter NF area is slower than for output (2.1%) but faster than for employment growth in the SAA (1.9%). The

faster growth rate for output compared to employment in the Forest and SAA suggests that both areas have invested in capital equipment that provides productivity gains which result in higher levels of output growth relative to employment growth.

A principal way an economy grows is by exporting goods and services. Most typically, manufacturing activity is thought of as providing most of this export-related activity. However, services and retail trade can be considered "export" industries if significant visitors come in from outside the analysis area and participate in travel-related activities to bring in new dollars. In this context tourism can be classified as an export-driven activity. A manufacturing industry can be a net importer if it imports more of a commodity than it exports.

The level of net exports for sectors in the IMPLAN analysis is presented in Appendix I Table 14. In this table the tourism detail is presented. Table 3-137 compares a summary of tourism and other selected sectors in the Sumter NF analysis.

Table 3-137. Exporting Industries

EXPORTING INDUSTRIES				
Commodity	**Net Exports* (Exports Less Imports)**		**Net Exporting Industries as a Percent of Total Positive Exporting Industries**	
	1985	**1996**	**1985**	**1996**
SELECTED MFG.				
Lumber & Wood Prod.	$125.8	$277.5	-6.7	10.0
Wood Furn. & Fixtures	-$21.0	-$35.9	0.0	0.0
Pulp & Paper Products	-$109.8	-$161.6	0.0	0.0
Total Manufacturing	$1463.2	$2291.3	77.9	79.8
Tourism Trade-Estimate	-$22.5	-$45.4	0.0	0.0
EXPORTS				
Total Net Trade	-$645.1	-$1324.0		
Total Positive Trade Ind.	$1877.2	$2772.8		

*Million Dollars

Source: IMPLAN 1985 and 1996 data

Table 3-137 shows that this local economy was a net importing economy in 1985 (-$645.1 million) and became more dependent on imports in 1996 (-$1342.0 million). The change that has taken place in the wood and wood-related product industries is reflected above. The "Lumber & Wood Prod." Sub-sector was the only wood and wood-related products sub-sector that was a net exporter ($125.8 million in 1985). This sub-sector increased its net exports ($277.5 million) in 1996.

The other two sub-sectors "Wood Furn. & Fixtures" and "Paper & Paper Products" were net importers in 1985 and became larger net importers in 1996. Total manufacturing was

a net exporter in 1985 and increased its net exports level in 1996. Tourism was a net importer in both time periods.

The sum of all sectors or sub-sectors, when sub-sector detail is provided, with a positive net export value ("EXPORTS-Total Positive Trade Ind." in Appendix I table 14) provides the basis for determining a commodities share of total net exports. This computation is only valid for sectors or sub-sectors which are net exporters (positive values). Manufacturing in 1985 had net exports of $1463.2 million and this was 77.9 percent of the $1877.2 million for all net exporting industries in the Forest area. The only other major sector that reflected positive net exports was "Transportation & Utilities" and the "Government" sector. "Finance, Insurance and Real Estate" and "Services—Non-Tourism" were two sectors with large net imports contributing to a drain of money from the local economy. The sub-sector estimate for tourism suggests that spending in the analysis area by travelers coming from outside the Forest areas was less than expenditures of residents traveling outside the area. Further, net imports in this sub-sector actually increased between 1985 and 1996.

The Sumter NF analysis area can be contrasted with the SAA area, which was a net exporter in 1991 of goods and services of $25.5 billion. Manufacturing was the largest net exporting sector, representing $24.6 billion. Thus, manufacturing represented 96.5 percent of the net exporting sectors in the SAA. Construction (-$6.7 billion) and Services (-$4.3 billion) were the largest net importers and contributed to a drain of money from the SAA economy.

The Sumter NF analysis area economy was a net importer in 1985 and increased in net imports in1996 to a negative $1,324.0 million. Manufacturing dominated the positive trade industries. "Lumber & Wood Products" was an important sub-sector of manufacturing with regards to positive trade.

Another way to indicate diversity of an economy is with the Shannon-Weaver Entropy Indices of diversity. This process allows a relative measure of how diverse an area is with a single numerical index. The entropy method measures diversity of a region against a uniform distribution of employment where the norm is equi-proportional employment in all industries. All indices range between 0 (no diversity) and 1.0 (perfect diversity). These two extremes would occur when there is only one industry in the economy (no diversity) and when all industries contribute equally to the region's employment (perfect diversity). In most cases diversity would be registered somewhere between these two extremes. Another factor affecting the magnitude of the index is the number of industries in a local economy: the more industries, the larger the index.

The Shannon-Weaver Entropy index is presented for all Forest counties in Appendix I Table 18. The indices contrast the change in diversity from 1977 to 1993 at the four digit SIC level, or at the industry level. Indices for South Carolina and the United States are presented as comparison guides. In Table 3-138, selected counties are presented for comparison.

Table 3-138. Shannon-Weaver Entropy Indices

SHANNON-WEAVER ENTROPY INDICES		
Forest Boundary Counties	**1977 Four Digit SIC**	**1993 Four Digit SIC**
Laurens	0.51683	0.63186
McCormick	0.37419	0.51513
Newberry	0.52785	0.61425
Saluda	0.49949	0.53140
Forest Boundary Area (Weighted average)	0.45855	0.58773
South Carolina	0.59504	0.71523
United States	0.66483	0.73973

Source: USDA Forest Service, IMI

In 1977 McCormick County, South Carolina, was the least diversified and Newberry County was the most diversified within the Sumter NF analysis area. McCormick was 59 percent less diverse than the State of South Carolina. Newberry County was only 12.7 percent less diversified than the State in 1977 [(.59504/.52785)-1].

Between 1977 and 1993 all Forest counties became much more diversified. McCormick County was the least diversified in 1977 and maintained this status in 1993. It was 38.8 percent less diversified than the South Carolina in 1993. This county improved its diversity standing by 37.6 percent between 1977 and 1993. Saluda County showed the least improvement in diversity between 1977 and 1993, increasing only 6.3 percent.

On a weighted average aggregate employment basis, the Sumter NF economy was about 29.7 percent less diversified than the South Carolina State economy in 1977 and about 22 percent less diversified in 1993. Laurens was the more diversified county in 1993 and was only13.1 percent less diversified than the State of South Carolina.

In summary, the Sumter NF area economy is less diverse than the regional South Carolina economy, but these rural counties and the Forest area as a whole has become more diversified over the 16 year period analyzed. The Forest area has increased it's diversity by about 28 percent compared to a 20 percent increase by the State.

Twenty-five percent of the monies received from natural resource consumption (25% Funds), such as timber harvesting, mining and recreation, on National Forest lands are paid to the counties with these lands. If these payments by the Forest Service do not amount to at least $1.75 per acre, then Payments in Lieu of taxes (PILT) are used to address the shortfall. The PILT payment is administered by the Bureau of Land Management.

The level of these payments and trends over time are important to the individual counties involved. Trends in 25% Funds and PILT are important because declines or even slow growth can put additional pressure on the area tax base. Table 15 and 16 of Appendix I G provide information on revenues for each of the eleven Forest counties. The last year 25 percent funds information available is for 1997. Aggregate amounts and change from 1990-1997 is presented in Table 3-139.

Table 3-139. 25% Funds and Pilt Funds

25% FUNDS AND PILT FUNDS			
Forest County Area	**1990**	**1997**	**% Change 1990-1997**
25% Funds	$1,337,606	$1,020,541	-23.8%
PILT	$ 44,190	$ 42,715	-3.3%
Total	$1,381,796	$1,063,256	-23.1%

Source: U.S. Dept. of Interior

County revenues from 25 percent funds vary annually depending on timber harvest, mining and recreation use for that year. The trend over time has been down, however, because of a reduction in timber harvesting. PILT payments have not made up for the shortfall and there has been a decline in the total payment of 23.1 percent from 1990 to 1997. One reason for this is that PILT comes from Federal government monies specific to the program and appropriated prior to the availability of information on whether a shortfall will exit and if so its magnitude. Sometimes the appropriated money is inadequate to cover the shortfall. It would appear that this has caused a substantial decline in payments to Sumter National Forest Counties.

Recent legislation, Secure Rural Schools and Community Self-Determination Act of 2000 (PL106-393), provided counties with two options. They could continue to receive payments under the 25 percent fund payment process currently in effect or elect to receive their share of the average of the three highest 25 percent payments during the period of 1986 through 1999. The second option, called the full payment option, was selected by all Forest Area Counties. The 25 percent fund monies have continued to decline since 1997 and amounted to only $544,500 in year 2000. When the full payment option takes effect the Counties will receive nearly $2.2 million per year.

Land use and its change over time is an indicator of the dynamism of an area (see Table 3-140). Areas converting from rural uses to urban uses have implications of change that affect residents. The table below shows weighted average land use for the Sumter NF analysis area. All land uses, except urban, for 1982 and 1992 are presented. Urban land use comprises a small share of total land use and can be found along with characteristic of individual counties in the analysis area in Table17 of Appendix I G.

Table 3-140. Land Use

LAND USE						
	% Share					
	Forest		**Farm**		**Residual**	
	1982	**1992**	**1982**	**1992**	**1982**	**1992**
Forest Counties						
Weighted Ave.	17.3%	15.7%	63.9%	63.6%	16.0%	16.9%

Source: USDA Natural Resource Conservation Service

This data set from the Natural Resource Conservation Service includes federal land within the residual category. Residual also includes highways and power line access right of ways. Thus, changes in the "Forest" category reflect changes in private forest land and not National Forest Systems lands. This category has declined about 1.6 percent over the 10-year period. The urban share ranged from 2.9% in 1982 to 3.8% in 1992 (see Table 17 of the Appendix I). Only minor changes have occurred in any land use category between 1982 and 1992.

In the SAA it was found that little forest-land was lost between 1970 and 1990 in the analysis area. However, urban, road and housing development growth caused by increased population in the area decreased farmland, pasture, and open space. Retirees and commuters from nearby urban centers were responsible for part of that demand for development.

Summary of Demographic and Economy Changes

Population and economic dynamics are changing at a moderate rate within the Sumter NF analysis area. Population growth was slightly less than ten percent in the 1980's and increased to a growth rate of slightly over 10 percent in the 1990's. The Forest area population grew faster than the State between 1990 and 2000 but did not keep up with the State growth rate in the 1980's period.

The minority population in the Forest area was very similar to the State level of approximately 30 percent in both analysis periods--1980's and 1990's. This indicates no trend in net migration to or from the Forest area and the State as a whole. The percent of minority population is considerably above the national average of 13 percent. This suggests a relatively high opportunity for minority participation in local recreational endeavors.

A major difference exists between the Forest area and the State with regards to its rural character of the population. The Forest is much more rural, 100 percent rural in one county, and over 70 percent rural Forest-wide. Further, the Forest actually increased its

rural representation in the 1990's. The State as a whole realized a slight decline during this period.

The Forest area's economic health, as measured by per capita income, grew at a robust rate during the 1980's--2.1 percent per year, but this rate was not quite equal to the State rate of 2.4 percent. Average per capita income in the Forest was slightly less than the State in 1980. The gap was widened during the 1980's and The Forest was $1700 behind in 1990. Unemployment decreased between 1990 and 1997, but remained substantially higher than for the State as a whole.

With a steady income growth rate and a downward trend in the unemployment, the area economy appears strong and stable. People with increasing incomes and adequate employment are likely to have the time and resources to pursue recreational activities. The national forest can be a prime outlet for some types of recreational activities.

The Forest poverty rate remained constant between 1989 and 1995. It was 1.0 percent above the State in 1995 and substantially above the SAA in 1989. Households with female heads increased between 1980 and 1990 but the rate was comparable to the State level in 1990--7.5 percent. These two characteristics are in a range that could detract from economic growth comparable to other areas. Household density, however, was 2.5 persons per household in 2000 which was very comparable to the State and SAA.

The Sumter NF analysis area's economy was very dependent on manufacturing in 1985 and became slightly more dependent in1996, with 82.6 percent of it net exports coming from the manufacturing sector. As measured by total output in 1996, manufacturing was about 54 percent of the economy but substantially less if measured by employment—33.5 percent. Services and retail activity have gained in shares of the economic activity during this period. "Lumber and Wood products" was the only wood-related sector that gained in importance, from 2.8 percent to 3.4 percent. "Wood Furniture & Fixtures" and "Paper & Pulp Products" both declined. These three sectors make up the wood products manufacturing component of the economy and their share of the total Forest area economy was about 3.7 percent in 1996.

In general, economies that export more than they import are able to grow faster than those that are net imports. The Forest was a net importer ($645.1 million) in 1985 and this level of net imports increased to $1,324.0 million in 1996. Wood products and tourism are two sectors examined in more detail with regards to net exports. Tourism was a net importer in both 1985 and 1996. "Lumber and Wood Products" was a net exporter in 1985 and increased its net export level to $277.5 million in 1996. "Wood furniture & fixtures" and "Paper & Pulp Products" were both net importers in 1985 and 1996.

A different indicator of economic diversity is the Shannon-Weaver Entropy indices. The index value ranges from 0.0 to 1.0 with 1.0 reflecting complete diversity. The Forest Areas had a Shannon-Weaver Entropy index value of .58773 in 1993. The State value for this period was .71523.

Land use changed very little between 1982 and 1992. The Forest area has lost about one and a half percent of the forest land cover in private lands. It is assumed that forested public lands are essentially unchanged during this period.

Thus, the Forest area economy and demography reflect a strong rural base. The economy appears healthy, but very dependent on manufacturing and not positioned for rapid growth. Population, housing, employment and income continue to increase which will generate some additional pressure for leisure time activities. The demand for such activities will not be as prevalent as would be expected in a more urban setting.

Demographic Changes Effect on Natural Resource Management

The Southern Appalachian Assessment found that while little forest land has been lost since 1970 in the region, urban, road and housing development growth, caused by increased population, has taken farmland, pastures and open space. Retirees and commuters from nearby urban centers are responsible for part of this demand for development.

Newcomers to the region feel differently than long-time residents about natural resource preservation. Often, the latter's livelihood depended upon manufacturing from natural resources. Managers of natural resources have had to respond to new sets of values and preferences, particularly increased demand from land and water resources for scenery, recreation and tourism.

Population in the region is projected to grow by 12.3 percent by 2010, slightly less than the growth rate expected for the nation (13.1 percent). Most of the growth is expected to be in northern Georgia, western North Carolina, and portions of eastern Tennessee and northwestern Virginia.

The increase in population density across all counties in the southern Appalachian region has impacted farms, forests, and pastures and has removed habitat for most species of wildlife and fish. More people entering the area has resulted in greater amounts of land conversion and impacts to water quantities, quality, and use. At higher elevations, development has impacted visual qualities.

As certain areas of the southern Appalachians have been developed, more urban pressures have impacted the land. Private lands have become posted as "off limits", causing public lands to become more crowded. This greater private land restriction, occurring in this area, has put more pressures on public land to accommodate increased demand for tourism and recreation.

The following analysis of details the Sumter NF market area and presents estimates of the percentages of persons 16 or older fitting various personal and household profiles who live in the forest impact area. The results were taken from the "Public Survey Report, Public Use and Preferred Objectives for Southern Appalachian National Forests", Forest

Service, Southern Research Station, p.12. (see Table 3-141, below). A forest market area includes all counties within a 75-mile radius of the boundary of the forest. A subregion market area includes all the counties within the combined 75-mile radii of the forests covered by this report

As with the Sumter NF other forests in the SA region show little difference in characteristics than was found in the Sumter NF forest market areas.

Most people, age 16 and over, in the Sumter NF market areas live year round (96% to 97%), leaving only 3 to 4 percent being seasonal residents.

Between 36 and 40 percent of residents surveyed had lived in the areas within the Southern Appalachian Region their entire lives and between 49 and 53 percent had lived in those areas more than 20 years (percentages which include those who have lived there all their lives). Just over 30 percent had lived there less than 10 years, however, indicating a fairly sizeable portion of the population that has been mobile and a large contingent of recent immigrants. For people living in the Sumter market areas, a majority, over 53 percent, remain in the sub-region because of family ties. Very few, around 7 percent, remain for their job and only about 15 percent remain because of attachment to the area itself.

Around 12 percent of responding residents are owners of 5 or more acres of rural land. About 27 percent are under age 30, about 26 percent are over age 55. Most of the surveyed population are between the ages of 30 and 55. About 77 percent are non-Hispanic White, 17 percent are Black, and around 3 percent are Hispanic. About 2 percent are foreign born. Around 7 percent have less than a high school education and around 23 percent have a college degree. Well over 70 percent of persons 16 or older, therefore, have a high school diploma or a diploma and some college experience. About 63 percent work a job while over one-third are retired. More and more, the national forests with their natural and scenic amenities are seen as popular retirement locations.

Table 3-141. Percentage of local residents 16 or older by personal or household characteristic by forest, sub-region, and region-wide in the Southern Appalachians, 2002.

Personal and Household Characteristics	Sumter Market Area	Southern Appalachian Region Market Area
Year-round resident	97.5	97.2
Part-time resident	2.5	2.8
Percentage of residents in market area by state	GA 33.0 NC 24.8	GA 24.2 AL 21.4
	SC 23.7	TN 14.3
Lived in SA entire life	36.4	38.1
Lived in SA 20+ years	48.1	51.7
Lived in SA 10-19 years	20.7	19.0
Lived in SA <10 years	31.2	29.3
Remain in the SAs for job	6.9	7.4
Remain for family in the SAs	53.0	54.8
Remain for the SA area itself	14.8	14.6
Remain for other reasons	25.3	23.2
Own 5+ acres of rural land	12.2	13.1
Age under 30	26.8	27.2
Age over 55	26.3	27.3
White, non-Hispanic	77.1	74.5
Black, non-Hispanic	17.2	19.7
Hispanic	3.4	3.6
Foreign born	2.2	1.8
Education - 8th grade or less	6.8	7.3
Education - Bachelor's degree/more	23.3	21.0
Work a job	63.1	59.9
Retired	39.6	39.5

1 Source: National Survey on Recreation and the Environment, Version 12, 11/2001 to 4/2002.

Management of Natural Resources' Impact on Economic and Social Status of Local Communities

The Southern Appalachian Assessment found that residents of communities near public land are sensitive to land management choices. Further, it found the region's communities are still in a lower economic status than surrounding state populations. Likewise, their economy is heavily dependent on natural resources than those of the states that comprise the southern Appalachianns. Of particular concern to residents of the area, is the need to balance local interests to those interests of retirees, logging, and tourism.

For the Sumter NF market area increased population growth and development is changing the character of the landscape. Continuing growth and development is reducing the open space that is now farms, forests, and pastures. This development may reduce wildlife habitat, change the scenic character of the landscape, and increase the wildland/urban interface concerns.

Values and Attitudes of Southern Appalachia Residents Toward Natural Resources and Ecosystem Management

Natural resource management attitudes and values that residents of the SAA hold are extremely important for land managers to realize. Research done during the SAA analysis showed that most people felt that environmental protection and economic growth can be compatible. However, when people had to choose between the two, their first choice was the environment. Most people felt that environment protection has **<u>not</u>** gone far enough. SAA residents have indicated a willingness to put more personal funds toward collective environmental protection.

Furthermore, the SAA found that as retirees, urban transfers, and other new residents move into the SAA region, concerns for the health and aesthetic appearance of the region's ecosystems were likely to strengthen.

Although the SAA attempted to determine the values and attitudes of Southern Appalachian residents toward natural resources and ecosystem management, it was primarily regional information. In order to gain more specific information about people's attitudes, beliefs and lifestyles at the local level, a public survey was conducted through the Southern Research Station in conjunction with the Human Dimensions Research Lab at the University of Tennessee (Cordell et. al., 2002).

Findings of this public survey for the Sumter NF include a high value to market area residents for the protection of sources of clean water; the legacy of passing along natural forests to future generations; the protection for wildlife and habitat, healthy forests, maintenance of places that are natural in appearance, and for protection of rare or endangered species.

Outdoor recreation and timber, as values of national forests, are in the second or lower one-half of the list of values. Table 3-142 illustrates the values of local area residents more specifically.

Table 3-142. Percentage of local and regional residents 16 or older indicating the stated value is important (left of /) and percentage indicating extremely important (right of /) to emphasize in management of the listed national forest, by forest, sub-region, and region-wide in the Southern Appalachians.

Forest Value	Sumter Market Area		Southern Appalachian Region Market Area	National
Protect sources of clean water	95.3/87.9		94/86.3	94.1/82.7
Maintain for future generations	92.3/84.9		92.7/83.7	92.5/80.4
Provide protection for wildlife	89.9/74.7		88.8/72.4	88/69.4
Emphasize healthy forests	88.9/71.6		87.7/70.5	N/a
Leave them natural in appearance	88.2/70.5		85.9/68.6	85.6/64.3
Protect rare or endangered species	83.9/71.6		83.1/69.7	84.7/67.1
Provide information and educational services	79.8/56.1		80.1/55.9	79.1/52.5
Provide natural places for personnel renewal	76.4/52.8		74.1/47.8	73.4/44.8
Provide Outdoor Recreation	72.5/45.1		72.3/54.8	77.7/57.6
Provide abundant timber supply	71.2/52.0		75.8/54.2	73.9/49.1
Help local tourism businesses	52.4/30.8		57.3/36	56/31.1
Permit grazing of livestock	42.4/23.8		45.2/26.5	49.8/28
Provide raw materials and products for local industries	34.5/19.9		38.7/22.3	45.1/24.9

Source: National Survey on Recreation and the Environment, Version 12, November 2001 to April 2002. National percentages are from NSRE Version 6 and 7, September 2000 to March 2001.

Not only were the findings for the Sumter National Forest comparable to those of neighboring national forests, but they also were quite comparable to national attitudes and values regarding natural resource management (see Table 2). This is further discussed in an article published in the **Journal of Forestry (October/November 2002, pp. 31-32),** which summarized a study done in the South.

Priorities for Management of Private Land by Non-industrial Owners

The SAA found that approximately 75 percent of the 37 million acres of the SAA region are privately owned. Of these 37 million acres approximately 19 million are forested acres. Three-fourths of the forest land in the region is privately owned.

Agriculture and timber harvesting are the overwhelming primary commodity uses of private undeveloped land. Recreation is the dominant non-commodity use. Raising livestock, recreation, enjoyment of a rural lifestyle, and having green space are most often listed as important reasons for owning land in the Southern Appalachians.

Private land dominates the South. Typically, corporate private owners provide recreation access by leasing their land to clubs, counties or others. Individual owners, however, usually open very little, if any, of their land to the public. Whether corporate or private, the number of landowners allowing public recreational access to their land has been decreasing over the years. It is expected that public access to private land will continue to decrease as more and more individuals and families purchase land for their own personal recreational pursuits. According to Cordell and Tarrant (2002),

A highly significant and growing issue nationally and in the South is that of conflict. Conflicts limit supply and increase the costs of management. Conflicts addressed in the SFRA included those between similar uses because of crowding; conflicts between non-similar uses because of incompatible norms, values and goals; and conflicts between users and providers.

Perhaps the most worrisome type of recreation conflict is that between users and owners of private tracts. These conflicts can and often do lead to posting and other ways of denying access, which act to limit supply. Because most of the forest-land in the South is privately owned, conflicts between recreational users and private forest-land owners are especially significant. Results from the 1995 National Private Landowner Survey, NPLOS 95…. suggest a number of possibilities for owner-user conflict. For example, about 59 percent of individual southern landowners indicate that improving wildlife, water, aesthetics and other natural components of their land is an important emphasis in their land management. Because landowners sometimes encounter use problems they may perceive to be incompatible with their conservation goals, land closure can result. The more prominent of such problems include dumping garbage, littering, illegal hunting and fishing, damage to fences and gates, damage to roads, disturbance of wildlife, and careless shooting.

Not all, maybe not even most, of these problems are the result of recreation use, although owners perceive them to be. As of 1995, about 41 percent of owners in the South posted their land. Among owners who already post some or all of their land, 16 percent anticipate posting more in the future. Very few anticipate posting less. Increasing demands for off-road vehicle use, hunting, fishing, and other of the more consumptive recreational activities are likely to bring about more recreation participant-land owner conflicts. In part as a response, many of the higher-income residents of the South are purchasing their own land for personal recreational pursuits. Very often these purchased lands end up being posted.

Direct, Indirect and Cumulative Effects

Social Impacts

During the forest planning process, numerous public meetings were held to allow attending interested people an opportunity to express their wants, needs and demands for access to and use of national forest resources. Many of these views were incorporated into our range of alternatives. These public meetings, however, typically represent only a portion of the public's interests and seldom represent the so-called "silent majority" who do not or cannot attend these meetings. Region 8 commissioned the Southern Research Station to undertake a telephone survey to randomly survey the public within a 75-mile radius of our national forests, which are under forest plan revision. Such a survey provides input from this broader public concerning what they would like to see emphasized in national forest management. For more information on how this survey was conducted, see the "Public Survey Report, Southern Appalachian National Forests, Sumter National Forest." Effects from our proposed land management alternatives on the public's preferences in land management follows below.

The public survey provided some information on the values residents have relating to natural resources. Well over 95 percent of the sample in the Sumter National Forest market area thought protection of clean water was an important management goal for national forests. Next highest percentages (92) were maintaining the forests in good condition for future generations, providing protection for wildlife and habitat (90), protection of trees for healthy forests (89), natural appearing forests (88), and protection of rare or endangered species (84). (See the Table 2)

The values favored least by survey participants included management of national forests to help local tourism industries, national forests as a source of grazing range for cattle, and national forests as sources of raw materials and products to support local industries and manufacturing.

People who reside in the areas near the Sumter National Forest put wildlife, ecosystems and naturalness above utilitarian objectives in the management of these national forests.

Possible management objectives of the forest were asked of respondents. The following analysis provides a comparison of the most favored management objectives versus the range of alternatives available to forest decision makers. (See the Public Survey Report, Table 5)

The continuum in the forest planning alternatives from more management activities and provision of multiple-use, to that of fewer management activities is as follows:

More Management Activities **Fewer Management Activities**

F D A I E B G

Over 93 percent of local residents favored a management objective that would protect streams, lakes and watershed areas.

> *Alternative F,* calls for water quality and riparian areas to be protected through BMP's. All the remaining alternatives call for water quality and riparian areas to be protected with the Riparian Corridor prescription. *Alternative A* would restore degraded watersheds and emphasize improvement of aquatic habitats and water quality. *Alternative I* provides resilient and stable conditions to ensure the quality and quantity of water necessary to support beneficial water uses. *Alternative B* calls for riparian ecosystems to be managed to maintain water quality. Degraded conditions would be restored. *Alternative E* provides for riparian ecosystems and streamside management zones to provide water-quality protection and improvement. *Alternative G* provides for riparian area protection and restoration through emphasis on watershed assessments. All alternatives therefore make some kind of provision for addressing clean water.

Next most favored management issues had to deal with naturalness. About 90 percent of respondents wanted the forest to be managed for wildlife by protecting their habitats; approximately 86 percent wanted management direction to protect old growth forests; approximately 82 percent want to see forests managed to provide habitat for wildlife and birds for people to see and photograph.

> *Alternative D* would have the least emphasis of all alternatives on "naturalness" Forests would appear highly variable in tree sizes and openings and the canopy may be seen from roadways and vista points. It would provide Old Growth only on unsuitable lands already withdrawn from the timber base would be recommended for wilderness. *Alternative A* provides high quality scenery in both a natural and managed settings. Highways and roads in the forests would have forest stands with few, if any, broken views to support enhancements to tourism. Roadless areas adjacent or in close proximity to wilderness areas would be recommended for wilderness designation. *Alternative I* provides for a healthy forest by managing ecosystems through restoration or maintenance to provide for designed species composition (species mix), structure (age class distribution),

function (resulting benefits), and productivity over time. A variety of large, medium and small old growth patches will be managed (through restoration, protection, or maintenance) to meet biological and social needs. *Alternative B* would emphasize the natural processes in a natural landscape pattern. Restoration activities could produce both large and small openings. *Alternative E* supports visual quality and most areas would maintain a forested canopy. A substantial amount of the forest would be allocated to providing old growth for biological and aesthetic settings. Many insect and disease impacts would be tolerated as part of a functioning natural ecosystem. Most wild and scenic rivers would be recommended for adding to the National Wild and Scenic Rivers System. *Alternative G* would provide for roadless areas to be recommended for wilderness. Emphasis would be on establishing a naturally resilient forest that would avoid large outbreaks of forest pests. Road network mileage would be reduced through closure of roads not needed for stewardship or restoration.

The management objectives favored least by percentage indicating them to be important include: Commercial leasing of oil and gas rights (22 percent), Expand access for motorized off-highway vehicles (22 percent), allow recreational gold prospecting and dredging (23 percent), provide new paved roads for cars (30 percent), allow harvesting an mining to support local industries (34 percent).

Alternative D emphasizes a balanced age class. All lands considered suitable for sustained-yield timber management would be available for sustained-yield management. Each major forest group---pine, mixed, and hardwood---would have specific target rotation ages. ***Alternative A*** provides sustained yield of wood products with an emphasis on high quality sawtimber. ***Alternative I*** allows forest management activities where needed and appropriate to achieve the desired composition, structure, function of forest ecosystems. A result of such activities will also be to provide a sustainable supply of wood products. ***Alternative B*** emphasizes restoring natural resources. Wood products would be managed in concert with restoration and creating wildlife habitats. Timber sales would be a by-product of restoration management. ***Alternative E*** provides for the overall long-term timber product objective of large-diameter and high quality sawtimber species. ***Alternative G*** emphasizes large undisturbed areas. High quality timber would be produced in long rotations in areas outside sensitive species habitat.

Recreation use as a forest management objective were thought as important by about 73% of our respondents

Alternative D provides for developed and dispersed recreation opportunities in both natural and managed settings. Potential for roaded natural experiences would increase as access roads for timber harvests are built or improved. Semiprimitive experiences would be designated for unsuited lands. ***Alternative A*** emphasizes developed and dispersed recreation opportunities achieved by commercial recreation and increased public access. Public access would be increased in high-use areas in order to provide more recreation opportunities.

Alternative I provides a spectrum of high quality, nature-based recreation settings and opportunities which are not widely available on non-federal lands. Hiking, biking, equestrian trail systems are emphasized in non-motorized settings with high quality landscapes. OHV routes are designated in proper settings. Hunting, fishing, and non-consumptive wildlife opportunities are also emphasized. Backcounty recreation experiences are also provided. ***Alternative B*** provides a variety of recreating settings in areas where they would be compatible with restoration activities. A wide variety of recreation activities would be provided. ***Alternative E*** emphasizes settings that would attract a variety of recreation users. Active resource management would be concentrated in certain locations that support recreation use and visual quality. Dispersed and developed recreation areas and opportunities would be increased. A variety of recreation experiences including concentrated use of off-highway vehicle use is provided. ***Alternative G*** emphasizes backcountry and nature-oriented non-motorized recreation opportunities; semiprimitive, wildlife, and nature-oriented recreation opportunities would be provided. Developed facilities would occur where they do not detract from ecosystem function and landscape connectivity.

Economic Impacts

Economic impacts of each proposed alternative are given in the tables below. Table 3-143 illustrates how the proposed alternatives differ from the current management direction (Alternative F) by jobs. Due to substitution effects from competing non-government sources, these jobs are characterized as being **associated** with local economic activity initiated by Forest Service programs and activities, rather than **caused** by these activities.

Employment changes from the current situation range from a decrease of 29.4 percent for Alternative B to an decrease of 2.2 percent for Alternative A. Jobs vary from a low of 1,270 for Alternative B to a maximum of 1,800 under the Current direction alternative. Timber and recreation are the programs that provide the most jobs in this economy for all alternatives.

Table 3-143. Employment by Program by Alternative

Employment by Program by Alternative (Average Annual, Decade 1)							
	Total Number of Jobs Contributed						
Resource	Current	Alt. A	Alt. B	Alt. D	Alt. E	Alt. G	Alt. I
Recreation	491	595	512	530	593	492	530
Wildlife and Fish	37	44	38	39	44	37	39
Grazing	0	0	0	0	0	0	0
Timber	939	805	446	796	556	382	649
Minerals	0	0	0	0	0	0	0
Payments to States/Counties	108	93	55	92	66	45	77
Forest Service Expenditures	225	223	220	223	221	208	222
Total Forest Management	1,800	1,759	1,270	1,680	1,479	1,164	1,517
Percent Change from Current	0.0%	-2.2%	-29.4%	-6.6%	-17.8%	-35.3%	-15.7%

Labor income by alternative is given in Table 3-144 below. The current direction alternative has $52.6 million of labor income associated with it. The range of labor income is $30.0 million for Alternative G to $52.6 million for current direction. The percent changes in income from current direction range from a decrease of –5.0% for Alternative A to —41.5% for Alternative G. Timber contributes the most income to the Forest total in all alternatives.

Table 3-144. Labor Income by Program by Alternative

Labor Income by Program by Alternative (Average Annual, Decade 1; $1,000,000)							
	Millions of dollars						
Resource	Current	Alt. A	Alt. B	Alt. D	Alt. E	Alt. G	Alt. I
Recreation	$10.2	$12.3	$10.6	$11.0	$12.3	$10.2	$11.0
Wildlife and Fish	$0.8	$0.9	$0.8	$0.8	$0.9	$0.8	$0.8
Grazing	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Timber	$30.1	$25.8	$14.2	$25.5	$17.8	$12.2	$20.7
Minerals	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Payments to States/Counties	$3.5	$3.0	$1.8	$3.0	$2.2	$1.5	$2.5
Forest Service Expenditures	$8.0	$7.9	$7.5	$7.8	$7.6	$6.1	$7.8
Total Forest Management	$52.6	$50.0	$34.9	$48.1	$40.7	$30.8	$42.8
Percent Change from Current	0.0%	-5.0%	-33.7%	-8.5%	-22.5%	-41.5%	-18.6%

Employment and income found in Tables 3-143 and 3-144, respectively, are divided into the major sectors of the Sumter National Forest economy in Tables 3-145 and 3-146. For

all alternatives, Manufacturing followed by Retail Trade, Services and Government are the sectors most affected by Forest Service programs and expenditures. To the extent that an alternative has a commodity program, manufacturing is the primary sector affected to a significant degree. Labor income in the form of wages and proprietors' earnings, has a similar effect as employment on the Manufacturing sectors of this economy.

Table 3-145. Employment by Major Industry by Alternative

Employment by Major Industry by Alternative (Average Annual, Decade 1)							
	Total Number of Jobs Contributed						
Industry	Current	Alt. A	Alt. B	Alt. D	Alt. E	Alt. G	Alt. I
Agriculture	24	25	19	23	23	18	22
Mining	0	0	0	0	0	0	0
Construction	44	40	26	39	31	22	34
Manufacturing	657	575	333	565	410	287	468
Transportation, Communication, & Utilities	40	38	26	37	31	23	32
Wholesale trade	51	51	37	48	44	34	44
Retail trade	371	409	327	375	380	307	359
Finance, Insurance, & Real Estate	40	39	27	37	32	24	33
Services	311	328	252	305	294	233	286
Government (Federal, State, & Local)	252	247	218	243	229	211	233
Miscellaneous	8	7	5	7	6	5	6
Total Forest Management	1,800	1,759	1,270	1,680	1,479	1,164	1,517
Percent Change from Current	0.0%	-2.2%	-29.4%	-6.6%	-17.8%	-35.3%	-15.7%

The magnitude of payments to counties expected in the first decade is shown in Table 3-147 below. Payments to the counties within the Sumter National Forest boundaries would range from $4.8 million for the current alternative to $2.0 million under Alternative G. It is important to note that these estimates are based primarily on the potential timber harvest and recreation use assumed for each alternative. Actual payments to the counties are based on recent legislation contained in the Secure Rural Schools and Community Self-Determination Act of 2000 (PL106-393). All the counties in this impact area selected the full payment option which allows each county to receive their share of the average of the three highest 25 percent payments during the period from 1986 through 1999.

Table 3-147. Forest Service Revenues and Payments to Counties

Forest Service Revenues and Payments to Counties (Annual Avg, Decade 1; $1,000,000)							
Forest Service Program	Current	Alt. A	Alt. B	Alt. D	Alt. E	Alt. G	Alt. I
Recreation	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Wildlife and Fish	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Grazing	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Timber	$19.3	$16.5	$9.7	$16.4	$11.6	$8.0	$13.6
Minerals	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Soil, Water & Air	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Protection	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Total Revenues	$19.4	$16.6	$9.8	$16.5	$11.7	$8.1	$13.7
Payment to States/Counties	$4.8	$4.1	$2.4	$4.1	$2.9	$2.0	$3.4

Cumulative effects analysis is designed to reveal the context of alternative impacts within the planning area and over time. This is done by comparing total changes in the planning area *with* each alternative to total changes *with* no action. Such a comparison is done by estimating employment and income at the expected end of the forest planning horizon (15 years) and calculating the share of the total economy that each alternative represents of the entire economy. Estimates for employment and income growth were derived by calculating the average annual increase in employment and the real average annual income growth for counties in the analysis area from 1969 to 2000 using U.S Bureau of Economic Analysis county-level data (www.bea.doc.gov).

The analysis assumes that the underlying economic relationships are held constant at the 2000 levels. Forest Service data related to Forest Service programs are for the fifteen year planning horizon. Also, the assumption made in our analysis is that the same rate of growth experienced during the 1969 to 2000 time period will continue over the 15 years of the forest plan.

Table 3-148 displays the cumulative effects results using employment and labor income for the planning area. The first two columns present the 2000 base year data for the planning area and the portion of the base year attributable to use and management of the national forest. The next column shows projections made for 2015. Included in the projections are employment and income effects attributed to the current direction (or no action) alternative. The remaining columns of the table show the cumulative effects for each alternative over the planning horizon, which ends in 2015. Forest program outputs for each alternative are for the 15-year planning horizon. .

In 2000 management of the national forest accounted for 1.1 percent of all **employment** under the no action alternative, and 1.0 percent in 2015 for the no action alternative. For the proposed alternatives in the EIS, expected shares of the economy will range from 0.6

percent of the economy for alternative G to 1.0 percent for alternative A. The preferred alternative I shows a 0.8 percent share of the local economy in 2015.

Employment changes in 2015 from the no action alternative range from -2.2 percent for alternative A to -35.3 percent for alternative E. The preferred alternative I shows a -15.7 percent change.

In 2000 management of the national forest accounted for 1.3 percent of all labor **income** under the no action alternative, and 0.9 percent in 2015 for the no action alternative. For the proposed alternatives in the EIS, expected shares of the economy will range from 0.5 percent of the economy for alternative G to 0.9 percent for alternatives A and D. The preferred alternative I shows a 0.8 percent share of the local economy in 2015.

Income changes in 2015 from the no action alternative range from –5.0 percent for alternative A to -41.5 percent for alternative G. The preferred alternative I shows a -18.6 percent change.

The cumulative effects analysis shows that over time employment and income proportionate share of the economy that is attributable to national forest program management will decline for all alternatives. The no-action alternative (current direction) would be the largest contributor to the economy.

Table 3-148 Cumulative Economic Impacts in 2015

	2000		2015						
	Area	Forest	Area	Forest Portion					
Economic Indicator	Totals	Portion	Totals	Alt.F-NA	Alt. A	Alt. B	Alt. D	Alt. E	Alt. G
Employment									
Total (jobs)	158,784	1,800	180,816	1,800	1,759	1,270	1,680	1,479	1,164
% of Area Totals	100%	1.1%	100%	1.0%	1.0%	0.7%	0.9%	0.8%	0.6%
% Change from No Action	---	---	---	0.0%	-2.2%	-29.4%	-6.6%	-17.8%	-35.3%
Labor Income									
Total ($ million)	$4,179.0	$52.6	$5,652.0	$52.6	$50.0	$34.9	$48.1	$40.7	$30.8
% of Base	100%	1.3%	100%	0.9%	0.9%	0.6%	0.9%	0.7%	0.5%
% Change from No Action	---	---	---	0.0%	-5.0%	-33.7%	-8.5%	-22.5%	-41.5%

	2000		2015						
	Area	Forest	Area	Forest Portion					
Economic Indicator	Totals	Portion	Totals	Alt. I	--	--	--	--	--
Employment									
Total (jobs)	158,784	1,800	180,816	1,517	0	0	0	0	0
% of Area Totals	100%	1.1%	100%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
% Change from No Action	---	---	---	-15.7%	-100.0%	-100.0%	-100.0%	-100.0%	-100.0%
Labor income									
Total ($ million)	$4,179.0	$52.6	$5,652.0	$42.8	$0.0	$0.0	$0.0	$0.0	$0.0
% of Area Totals	100%	1.3%	100%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
% Change from No Action	---	---	---	-18.6%	-100.0%	-100.0%	-100.0%	-100.0%	-100.0%

Finally, Table 3-149 below illustrates the percentage contribution of the Sumter National Forest's current management program (Alternative F) to the area's economy. The Sumter National Forest is associated with 1 percent of the total local economy's jobs, and

0.9 percent of the labor income. Manufacturing, Retail Trade, Services, and Government are the sectors of the economy that show the most benefit from the forest's activities.

Table 3-149. Current Role of Forest Service-Related Contributions to the Area Economy

Current Role of Forest Service-Related Contributions to the Area Economy				
	Employment (jobs)		Labor Income ($ million)	
Industry	Area Totals	FS-Related	Area Totals	FS-Related
Agriculture	8,534	24	$103.6	$0.3
Mining	59	0	$1.9	$0.0
Construction	12,136	44	$378.4	$1.6
Manufacturing	58,073	657	$2,030.7	$23.6
Transportation, Communication, & Utilities	5,773	40	$303.6	$1.7
Wholesale trade	4,757	51	$142.5	$1.7
Retail trade	28,721	371	$457.7	$6.0
Finance, Insurance, & Real Estate	5,645	40	$131.7	$1.0
Services	30,959	311	$676.9	$6.9
Government (Federal, State, & Local)	29,230	252	$836.8	$9.7
Miscellaneous	1,365	8	$9.7	$0.1
Total	185,252	1,800	$5,073.5	$52.6
Percent of Total	100.0%	1.0%	100.0%	1.0%

Present Net Value of the Alternatives

Table 3-150 shows estimated benefits, costs, net benefits, and cumulative present net value (PNV) by alternative. All figures are in 2000 dollars. The benefits in Table 3-149 include market values and non-market estimated values. Market values include those values where the Forest Service receives money such as for timber, range, special uses, etc. Non-market values are estimated values for amenities such as wildlife and recreation.

Table 3-150. Cumulative Decadal Present Values of Costs and Benefits

Cumulative Decadal Present Values of Costs and Benefits in Millions of $2000							
	Alt A	Alt. B	Alt. D	Alt. E	Alt. F	Alt. G	Alt. I
Cummulative Total Present Net Value	$1,280,515	$1,053,140	$1,163,470	$1,219,837	$1,131,277	$998,427	$1,135,597
Present Value benefits by Program:							
Range:	$0	$0	$0	$0	$0	$0	$0
Timber:	$300,567	$207,489	$299,007	$233,169	$337,416	$150,507	$268,521
Minerals:	$0	$0	$0	$0	$0	$0	$0
Recreation	$411,913	$359,751	$369,456	$409,445	$345,933	$344,220	$369,456
Wildlife:	$789,059	$694,209	$714,593	$789,059	$673,826	$673,826	$714,593
PV of Benefits	$1,501,538	$1,261,449	$1,383,056	$1,431,673	$1,357,176	$1,168,554	$1,352,571
Present Value costs by Program:							
Range:	$0	$0	$0	$0	$0	$0	$0
Timber:	$47,696	$37,356	$48,850	$39,664	$57,471	$25,296	$44,823
Roads/Engineering	$31,348	$26,646	$31,348	$26,646	$31,348	$23,511	$31,348
Minerals:	$2,503	$2,503	$2,503	$2,503	$2,503	$2,503	$2,503
Recreation	$24,207	$20,811	$21,617	$24,207	$20,006	$20,006	$21,617
Wildlife:	$21,225	$25,470	$21,225	$25,470	$21,225	$16,980	$23,337
Soil, Water, Air..	$16,936	$18,417	$16,936	$16,240	$16,240	$15,434	$16,240
Protection/Forest Health	$53,552	$53,552	$53,552	$53,552	$53,552	$42,842	$53,552
Lands	$5,312	$5,312	$5,312	$5,312	$5,312	$5,312	$5,312
Planning, Inv., Monitoring	$18,243	$18,243	$18,243	$18,243	$18,243	$18,243	$18,243
PV Costs	$221,023	$208,310	$219,586	$211,836	$225,899	$170,126	$216,974

Alternative F (Current Management): This alternative provides more PNV than Alternatives B and G but less than Alternatives A, E, D, and I. It ranks fifth in terms of total PV benefits and highest in regards to PV costs. Overall this alternative ranks fifth in terms of total PNV.

Alternative A: This alternative has the highest PNV. With its emphasis on the production of goods and services beneficial to local economies and communities and the concomitant higher timber, recreation and wildlife benefits, this alternative provides the highest total PV benefits..

Alternative B: With an emphasis on natural resources and creating and maintaining wildlife habitats, this alternative has the highest wildlife costs of all alternatives with the exception of Alternative E, which has the same amount of wildlife costs. Overall, this alternative ranks sixth in terms of Total PNV.

Alternative D: This alternative provides the third highest Total PNV. While in terms of total benefits this alternative ranks third, it has the second highest total costs. This high cost is primarily due to this alternative's emphasis on increased timber production.

Alternative E: This alternative with its emphasis on a variety of recreation uses provides the second highest Total PNV. This alternative along with Alternative A has the highest wildlife benefits of all the alternatives and ranks second in recreation benefits.

Alternative G: This alternative has the lowest PNV because it has the lowest PV benefits. This is primarily the result of having the lowest timber, recreation , and wildlife benefits of all the alternatives with the exception of Alternative F, which has the same wildlife benefits.

Alternative I: This alternative provides more Total PNV than Alternatives F, B, and G but less than Alternatives A, E and D. In regards to PV benefits it ranks fourth and in regards to costs it ranks third. Overall this alternative ranks fourth in terms of total PNV.

UNAVOIDABLE ADVERSE EFFECTS

Implementation of any alternative would result in some adverse environmental effects that cannot be avoided. The application of the management prescriptions, standards, best management practices (BMP's), and monitoring and evaluation are intended to limit the extent, severity, and duration of these effects. Although the formulation of the alternatives included avoidance of potential adverse environmental effects, some adverse impacts to the environment that cannot be completely mitigated are expected to occur.

Some adverse effects are of a transitory type. For example, air quality could be diminished on a recurring, though temporary, basis due to the use of prescribed fire used to restore plant communities or enhance wildlife habitat. Even though standards require prescribed burning to be scheduled for times when weather conditions would provide for smoke dispersion, the presence of smoke and haze over or adjacent to the Forest would detract from people's expectation of clean air. Recreation traffic, timber hauling, and the operation of other internal combustion engines, could have localized and temporary adverse effects on air quality where these activities occur.

The natural landscape would appear altered by management activities, particularly where activity is highly visible from travel routes. Prescribed burning in forest communities and their blackened appearance would also be apparent. These temporary adverse effects would eventually be reduced by regrowth of vegetation and weathering. Other impacts on the natural appearance of the landscape include roads and certain recreational structures that are highly visible despite efforts to blend them with landforms and mitigate the effect by landscaping.

Disturbance, displacement, or loss of fish and wildlife may occur as a consequence of habitat loss and increased human recreational activity in areas. Roads and their associated use can impact fish and wildlife due to human activities associated with new access. Improved access into areas that previously had low-standard roads would have similar effects. Other wildlife use could increase by increased management.

Both the amount and distribution of mature stands would be changed through implementation of any alternative. The rate and severity of adverse impacts varies by alternative. Some wildlife species rely on habitat conditions provided by late successional habitats, a reduction or shift in the populations (range) of some wildlife species can be expected.

Although standards, BMPS, and monitoring plans are designed to prevent significant impacts to soil and water, the potential for impacts does exist. Sediment production could exceed natural rates in locations as long as roads are being built or maintained, management activities that include harvesting and removal of timber, dispersed and developed recreation continues along riparian corridors, and forest

communities/habitats are restored. Sediment would result from surface erosion, channel erosion, and mass movement.

Fire hazard and resistance to control would increase subsequently to designating more areas to either wilderness or allocations that would not be favorable to management activities, this would result in increased accumulation of forest residues. The potential for these adverse impacts increases relative to the lack of emphasis on management activities in the alternatives being considered. Wildfire risk would increase where access results in more people being drawn into an area. Some risk would be mitigated by early detection, suppression, and prevention methods. Long-term increases in fuel hazard would be mitigated through fuels management activities that are responsive to forest health management objectives.

RELATIONSHIP OF SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

The relationship between the short-term uses of man 's environment and the maintenance and enhancement of long-term productivity is complex.

Short-term uses are those that generally occur annually on parts of the Forest, such as prescribed burning and dispersed recreational camping.

Long-term refers to longer than a 10-year period, and productivity is the capability of the land to provide market and amenity outputs and values for future generations. Soil and water are the primary factors of productivity and represent the relationship between short-term uses and long-term productivity. The quality of life for future generations would be determined by the capability of the land to maintain its productivity. By law, the Forest Service must ensure that land allocations and permitted activities do not significantly impair the long-term productivity of the land.

The alternatives considered in detail, including the preferred alternative, incorporate the concept of sustained yield of resource outputs while maintaining the productivity of all resources. The specific direction and mitigation measures included in the Forestwide management standards ensure that long-term productivity would not be impaired by the application of short-term management practices.

Each alternative Forest Plan was analyzed using the Spectrum linear programming model (See Appendix B – Description of the Analysis Process), to ensure that the minimum standards could be met. The alternative was changed if some aspect did not meet any of the minimum standards. Through this analysis, long-term productivity of the Forest's ecosystems is assured for all alternatives.

Alternatives F, and D have the highest level of short-term uses, as reflected by the acres of vegetation treatment, and they therefore result in higher levels of short-term consequences such as visual impact, fire hazard, and increased sedimentation. In a decreasing order of short-term uses, Alternative A followed by Alternatives I, E, and B. Alternative G has the lowest level of short-term uses and therefore the lowest level of short-term consequences.

As stated earlier, the effects of short-term or long-term uses are extremely complex, and depend on management objectives and the resources that are emphasized. No alternative would be detrimental to the long-range productivity of the Sumter National Forest.

The management prescriptions and the effects of implementing the revised Forest Plan would be monitored to provide data that ensures satisfying standards for long-term productivity. Monitoring requirements and standards would apply to all alternatives, and are included in Chapter 5 of the revised Forest Plan.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible commitment of resources results from a decision to use or modify resources that is renewable only over a long period of time, such as soil productivity; or nonrenewable resources, such as cultural resources or minerals. The revised Forest Plan and the alternatives examined were all based on the principles of multiple use and long-term productivity for all resources. Measures to protect natural resources that could be irreversibly affected by management activities were incorporated into Forestwide standards.

Irretrievable commitment of resources is the production of renewable resources lost due to allocation decisions that forgoes the production or use of renewable resources. Allocation decisions that do not allow for the production or use of most renewable resources for relatively long periods of time include those that establish wilderness, roadless, scenic areas, wild and scenic rivers, recreation sites, and the construction of new roads. The total number of acres committed to these uses remains essentially the same for all alternatives, although the types of allocated uses vary. By contrast, non-wilderness allocation for areas is considered an irretrievable loss of increased wilderness opportunities. Tradeoffs between wilderness, roadless, and other uses are discussed previously in Chapter 3.

Under a given alternative, differences between output levels and the higher levels that otherwise could be produced also represent irretrievable commitment of resources. For example, a low level of forage use for livestock grazing or a low level of timber yield could be increased in the future, based on different management prescriptions, but the outputs between now and then would be “lost ” or not available for use. The production thus lost would be irretrievable, but the action is not irreversible.

Archeological resources are part of an absolutely nonrenewable and irreplaceable resource base. Once disturbed, for whatever reason, the impacted portion of a property cannot be replaced or repaired, even though controlled data recording techniques may recover part of the information contained in the damaged site.

Archeological surveys and evaluations routinely use small shovel tests or larger) excavations to address research designs or potential. These excavations represent the controlled destruction of a portion of an archeological site. The results of such excavations are an irreversible effect. This is balanced by using conventional, accepted archeological techniques and methods with a commitment to high standards.

Any other resource management action or result, whether planned or inadvertent, that diminishes the character or integrity of a heritage property, has irreversibly committed a portion of that site ’s value.

UNAVAILABLE OR INCOMPLETE INFORMATION

The Sumter National Forest has used the most current scientific information available and state-of-the-art analytical tools to evaluate management activities and to estimate their environmental effects.

However, gaps exist in our knowledge. The Council on Environmental Quality regulations discuss the process for evaluating incomplete and unavailable information (*40 CFR 1502.22 (a) and (b)*). Incomplete or unavailable information is noted in Appendix G of the Forest Plan.

Forest Plan monitoring is designed to evaluate assumptions and predicted effects. Should new information become available, the need to change management direction or amend the Forest Plan would be determined through the monitoring and evaluation process.

ENVIRONMENTAL JUSTICE

A specific consideration of equity and fairness in resource decision-making is encompassed with the concerns of environmental justice. As required by Executive Order 12898, all federal actions must consider potentially disproportionate effects on minority or low-income communities. Principles for considering environmental justice are outlined in Environmental Justice Guidance under the National Environmental Policy Act (Council on Environmental Quality 1997). Those principles were considered in this analysis.

The Social and Economic Environment section identified the demographics of minorities and low-income populations. The 11 county impact area basically reflects the same percentages of minorities and low-income populations as the state of South Carolina. Based on the disclosure of effects in Chapter 3 and the programmatic nature of these decisions, it can be concluded there are no disproportionately adverse environmental or health effects to low-income or minority populations. Public involvement during this plan revision was inclusive of all publics including minorities and low-income populations.

CHAPTER 4

LIST OF PREPARERS

A listing of the major preparers (interdisciplinary team) of the Draft Environmental Impact Statement for the Sumter National Forest and the revised Forest Plan follows. Experience and educational background have been included for these team members. The Forest Management Team and other contributors are also listed.

THE INTERDISCIPLINARY TEAM

John Cleeves –	Team Leader
Education	BS in Forest Management, MS in Environmental Planning/Operations Research, Colorado State University.
Experience	26 years of experience on 7 National Forests in 3 Regions.

Gary Peters –	Wildlife Biologist
Education	BS in Public Policy with a concentration in Environmental Science, Indiana University; AAS in Recreation and Wildlife Management, Hocking Technical College.
Experience	24 years with the US Forest Service on a variety of National Forests, serving in NEPA, Wildlife, and many different fields.

Robin Roecker –	Forest Botanist/Ecologist
Education	BS in Biology, Berry College; MS in Forest Resources, University of Georgia.
Experience	4 years in research and teaching; 12 years with the US Forest Service

Robbin Cooper – Landscape Architect/Recreation Planner

Education: BLA, Louisiana State University
Experience: 12 years, Francis Marion & Sumter National Forests

Jay Purnell – Forest Silviculturist

Education BS in Forest Management, Auburn University
Experience 24 years of experience on 3 National Forests in 2 Regions.

Bill Hansen – Forest Hydrologist

Education B.S. and M.S. degree in forestry from the University of Missouri, with an emphasis on hydrology.

Experience 28 years as a hydrologist for the USDA Forest Service, spending 8 years on the Siskiyou National Forest in Grants Pass, Oregon and 20 years on the Francis Marion National Forest in Columbia, South Carolina, with about 6 years of that time being shared with the Chattahoochee-Oconee National Forests in Gainesville, Georgia.

Eric Schmeckpeper – GIS Specialist/Analyst

Education B.S. in Forestry, University of Florida
M.S. in Forestry (Silviculture), N.C. State University
Graduate work towards MS in Geography, Murray State University, Kentucky

Experience 12 years experience with TVA at Land Between The Lakes National Recreation Area
5-1/2 years experience with USDA Forest Service on FMS in SC

Gail White – Public Affairs Specialist

Education BA in English, University of South Carolina

Experience 18 years experience with the US Forest Service

FORMER INTERDISCIPLINARY TEAM MEMBERS

Barry Lilly – Silviculturist
Marty Kindred – Silviculturist
Deryl Jevons – Public Affairs Specialist
Lauren Kindred – Wild and Scenic River Specialist

THE MANAGEMENT TEAM

Jerome Thomas – Forest Supervisor
Elizabeth LeMaster – District Ranger, Long Cane District
Mike Crane – District Ranger, Andrew Pickens District
Dick Rosemier – District Ranger, Enoree District
Orlando Sutton – District Ranger, Francis Marion
J. LaRue Bryant – Union President, Local # FL379
Stephen Wells – Fire, Lands and Minerals Staff Officer
Stephanie Neal-Johnson – Public Affairs Staff Officer
JaSal Morris – Administrative Staff Officer
Oscar Stewart – Wildlife, Timber, Fish, Water, Soils, Air and Rare Plants Staff Officer
Tony White – Planning, Recreation, Engineering, GIS and Heritage Staff Officer

FORMER MANAGEMENT TEAM MEMBERS

Angela Coleman – Public Affairs Staff Officer
David Carter – District Ranger, Long Cane District
Skip Starkey - Planning, Recreation, Engineering, GIS and Heritage Staff Officer
David Wilson – Forest Supervisor
Jerry Henderson - Wildlife, Timber, Fish, Water, Soils, Air and Rare Plants Staff Officer
Ron Smith – District Ranger, Enoree District
Beth Merz – District Ranger, Andrew Pickens
Ivan Cupp - Fire, Lands and Minerals Staff Officer
Don Kinnerson – District Ranger, Francis Marion

OTHER MAJOR CONTRIBUTORS

Ed Hedgecock – Forest Engineer
Bill Jackson – Air Quality Specialist
Robert Morgan – Archeologist
Jeanne Riley – Fisheries Biologist
Dennis Law – Soil Scientist
Laura Barrett – Fire

Charlie Kerr – Fire
Joe Robles – Recreation Program Manager
Paul Arndt – Regional Planner
Tim Mersmann – Regional Biologist
Clair Redmond – Regional Economist
Robert Wilhelm – Regional Planner

CHAPTER 5

FEIS DISTRIBUTION LIST

The *Final Environmental Impact Statement* for the Revised Forest Plan was distributed to agencies, organizations, and individuals as required by National Environmental Policy Act regulations (40 CFR 1502.19) and Forest Service Environmental Policies and Procedures Handbook (FSH 1909.15, 63.1-64). Further, organizations and individuals on the forest planning mailing list and those who commented on the DEIS were notified of the availability of both the plan and the FEIS in hard copy, on CD-ROM, and on the forest's website. Respondents received the documents in the format they requested.

This list is not intended to be complete; the complete mailing list is on file at the Forest Supervisor's Office, 4931 Broad River Road, Columbia, SC, 29212-3530, (803) 561-4000.

FEDERAL AGENCIES

Agriculture, U.S. Department of
Forest Service
Washington Office

Regional Offices

Region 1 – Missoula, Montana
Region 2 – Lakewood, Colorado
Region 3 – Albuquerque, New Mexico
Region 4 – Ogden, Utah
Region 5 – San Francisco, California
Region 6 – Portland, Oregon
Region 8 – Atlanta, Georgia
Region 9 – Milwaukee, Wisconsin
Region 10 – Juneau, Alaska

National Forests Supervisor's and Forest Manager's Offices

National Forests in Alabama
National Forests in Florida
National Forests in Mississippi
National Forests in North Carolina
National Forests in Texas
Caribbean (Puerto Rico)
Chattahoochee and Oconee (Georgia)
Cherokee (Tennessee)
Daniel Boone (Kentucky)
Kisatchie (Louisiana)
George Washington and Jefferson (Virginia)
Ouachita (Oklahoma and Arkansas)
Ozark-St. Francis (Arkansas)
Savannah River Forest Station (South Carolina)

District Offices of the Francis Marion and Sumter National Forests

Andrew Pickens
Enoree (both offices)
Long Cane
Wambaw/Witherbee

Forest and Ranger Experiment Stations

Southern Research Station

Natural Resource Conservation Service

Army Corps of Engineers

Environmental Protection Agency
Office of Environmental Affairs

Federal Congressional Delegation

Senator Ernest F. Hollings
Senator Lindsey Graham
Congressman Gresham Barrett
Congressman Jim DeMint
Congressman John M. Spratt Jr.

Federal Energy Regulatory Commission

Interior, U.S. Department of

- Bureau of Land Management
- Fish and Wildlife Service
- Geological Survey

STATE AGENCIES

- Clemson Extension Service
- Clemson University
- Department of Archives and History
- Forestry Commission
- Department of Health and Environmental Control
- Highway Department
- Governor's Office
- Parks, Recreation, and Tourism
- Water Resources Commission
- Department of Natural Resources

Western Carolina University

Georgia Wildlife Resources Department

STATE ELECTED OFFICIALS

Senator Thomas C. Alexander

<u>County/ City Officials and Agencies</u>

- Abbeville County Administrator
- Abbeville County Development Board
- Laurens County Administrator
- Newberry County Council

LIBRARIES

Abbeville County Library (Abbeville)
Aiken-Bamberg-Barnwell-Edgefield Regional Library (Aiken)
Chester County Library (Chester)
Edgefield County Public Library (Edgefield)
Fairfield County Library (Winnsboro)
Abbeville-Greenwood Regional Library (Greenwood)

Laurens County Library (Laurens)
McCormick County Library (McCormick)
Newberry County Library (Newberry and Whitmire branch)
Oconee County Library (Walhalla and Salem, Seneca, and Westminster branches)
Richland County Public Library (Columbia)
Saluda County Library (Saluda)
Union County Library (Union)

BUSINESSES AND ORGANIZATIONS

Alexandria Forestry Center
American Whitewater Association
Benefit Controls Companies
Black America Outdoors
Bowater Inc.
Canal Wood
Carolina Canoe Club
Catawba Regional Planning Commission
Chattooga Outpost
Chattooga River Watershed Coalition
Chattooga Whitewater Shop
Columbia Enduro Riders Association
Discover Upcountry Carolina Association
Foothills Paddling Club
Foothills Trail Conference
Forest Conservation Council
Forest Green Ltd.
Gun Shop
International Paper
John de LaHowe School
Keep America Free
Kiser Lumber Company, Inc.
McCormick Soil and Water Conservation District
National Forest Products Association
National Wildlife Federation
National Wild Turkey Federation
Naturaland Trust
Nature Conservancy
Newberry College
Newberry Opera House Foundation, Inc.
Norbord South Carolina Inc.
Pollard Lumber Company
Professional Paddlesports Association
Quail Unlimited Inc.
Resource Management Service

Ruffed Grouse Society
Sierra Club, South Carolina Chapter
Society of American Foresters
South Carolina Bow hunters Association
South Carolina Forest Watch
South Carolina Forestry Association
South Carolina Nature Conservancy
South Carolina Off-Road Enthusiasts
South Carolina Sportsmen's Coalition
South Carolina Timber Purchaser's Association
South Carolina Trout Unlimited
South Carolina Wildlife Federation
Southern Timber Purchasers Council
Southern Appalachian Biodiversity Project
Southern Appalachian Forest Coalition
Teachy Mechanical Inc.
Union Conservation District
Wall Grading
Westvaco Corporation
Wilderness Society, Southeastern Region

INDIVIDUALS

Copies of the FEIS were mailed to individuals that were on the forest's mailing list or who commented on the Draft Environmental Impact Statement (DEIS) and requested a copy. The mailing list and those who commented on the DEIS is on file in the Francis Marion and Sumter National Forests Supervisor's Office, 4931 Broad River Road, Columbia, SC, 29212-3530, (803) 561-4000.

CHAPTER 6

GLOSSARY

Acronyms

AA - analysis area
ACP – Agriculture Conservation Program
AD - Administratively Determined
ADA - Americans with Disabilities Act
AMS - Analysis of the Management Situation
APHIS - Animal and Plant Health Inspection Service
ASQ - allowable sale quantity
AT - Appalachian Trail
ATV – all-terrain vehicle
AUM - animal unit month

BA - basal area
BF - board foot
BMP - best management practice
BIO – biological oxygen demand
BSS - base sale schedule

CAA - Clean Air Act
CCF - hundred cubic feet
CEQ - Council on Environmental Quality
CF - cubic foot
CFL - commercial forest land
CFR - Code of Federal Regulations
CFS - cubic feet per second
CIP - Capital Investment Program
CISC - Continuous Inventory of Stand Conditions
CISE – Continuous Inventory of Strand Condition
CMAI - culmination of mean annual increment
CompPATS - Computerized Project Analysis of Timber Sales
CVHW - cove hardwood.
CWA - Clean Water Act
CWS – coarse woody debris

DBH - diameter at breast height
DBRU - Drainage Basin Response Unit
DEIS - Draft Environmental Impact Statement
DFC - desired future condition

EA – Environmental Assessment
ECOMAP - Ecological Classification and Mapping Task Team
ECS - Ecological Classification System
EIS - Environmental Impact Statement
EMU - ecological management unit
EPA - Environmental Protection Agency
ESA - Endangered Species Act
EWPP- Emergency Watershed Protection Plan

FDR - forest development road
FRP - Forest Road Program
FEIS - Final Environmental Impact Statement
FH - Forest Highway
FIA - Forest Inventory and Analysis
FMAP - Fire Management Action Plan
FR - Forest Road
FSH - Forest Service Handbook
FSM - Forest Service Manual
FTE - full-time employee
FY - fiscal year

GAO - Government Accounting Office

GFA – General Forest Area
GIS - Geographic Information System
GPD - gross domestic product

HRP - Human Resource Program
HUC – Hydrologic Units

IDT - Interdisciplinary Team
IPM - integrated pest management
IS - Interpretive Services

LAR - Land Area Report
LE - law enforcement
LOAS – Land Ownership Adjustment Strategy
LTA - landtype association
LTP - landtype phase
LTSYC - long-term sustained-yield capacity
LUG - land-use group
L&WCF - Land and Water Conservation Fund

LWD – large woody debris

M - thousand
M$ - thousands of dollars
MA - management area
MAR - Management Attainment Report
MAUM - thousand animal unit month
MBF - thousand board feet
MCF - thousand cubic feet
MIL - management intensity level
MIS - management indicator species
MM - million
MM$ - millions of dollars
MMBF - million board feet
MMCF - million cubic feet
MMR - minimum management requirement
MMRVD - million recreation visitor-day
MOU - memorandum of understanding
MRVD - thousand recreation visitor-day
MWFUD - thousand wildlife and fish user-day

NAAQS - National Ambient Air Quality Standards
NAPAP – National Acid Precipitation Assessment Program
NEPA - National Environmental Policy Act
NF - National Forest
NFMA - National Forest Management Act
NFRS – National Forest Recreation Survey
NFS – National Forest System
NFSR – National Forest System Road
NIPF – Non-industrial Private Landowner
NLFCA – National Listing of Fish Consumption Advisories
NOAA – National Oceanic and Atmospheric Agency
NPL – National Priorities List
NPS – National Parks Service
NRCS - Natural Resources Conservation Service
NRI – Natural Resource Inventory
NSO – no surface occupancy
NTMB - neotropical migratory birds
NVUM – National Visitor Use Monitoring
NWPS - National Wilderness Preservation System

OHV - off-highway vehicle
OMP - operation maintenance and protection
ORV - off-road vehicle

PAOT - persons-at-one-time
PETS - proposed, endangered, threatened, or sensitive
PNWR - Piedmont National Wildlife Refuge
PL - public law
PM - particulate matter
PNV - present net value
PNW - present net worth
PRODCL - productivity class
PSD - prevention of significant deterioration
PSI - pounds per square inch

RAP – Roads Analysis Process or Procedure
RARE - Roadless Area Review and Evaluation

RARE II - the second Roadless Area Review and Evaluation
RBP – Rapid Bioassessment Protocol
RCW - red-cockaded woodpecker
RCW EIS - Final Environmental Impact Statement for the management of the Red-cockaded Woodpecker and its habitat on National Forests in the Southern Region
RD - Ranger District
RIM - Recreation Information Management
RMO – Road Management Objectives
RNA - research natural area
RNAT - roaded natural
ROD - record of decision
ROS - Recreation Opportunity Spectrum
ROW - right-of-way
RPA - Resources Planning Act
RVD - recreation visitor-day

SAA - Southern Appalachian Assessment
SCORP - State Comprehensive Outdoor Recreation Plan
S&G - standard and guideline
SH - state highway
SIO – Scenic Integrity Objective
SIP - State Implementation Plan
SMS – Scenery Management System
SPB - southern pine beetle
SPMO - semiprimitive motorized
SPNM - semiprimitive non-motorized
SMZ – Streamside Management Zone

T&E - threatened and endangered
TNC - The Nature Conservancy
TSI - timber stand improvement
TSPIRS - Timber Sale Program Information Reporting System
TVA - Tennessee Valley Authority

UPLD - upland hardwood/mixed
USC - United States Code
USDA - U.S. Department of Agriculture
USDI - U.S. Department of Interior
USFWS - U.S. Fish and Wildlife Service
USGS - U.S. Geological Survey

VIS - Visitor Information Services
VMS – Visual Management System
VQO - visual quality objective

WFUD - wildlife and fish user-day
WHI - wildlife habitat improvement
WIN - Watershed Improvement Inventory
WO - Washington Office
WPIN - white pine
WRD - Wildlife Resources Division
WRP – Wetlands Reserve Program
WSA - wilderness study area
WURR – Water Use Rights and Requirements

YPIN - yellow pine

Definitions

Definitions were taken from the following sources:

Code of Federal Regulations (CFR) Title 36, *Parks, Forests, and Public Property,* Chapter II, Forest Service, Department of Agriculture; Part 219, Planning, Section A—National Forest System Land and Resource Management Planning; Section 219.3, Definitions and Terminology, Revised July 1, 1998. (Referred to as 36 CFR 219.3)

Forest IDT is the Interdisciplinary Team on the Chattahoochee-Oconee NFs. (Referred to as Forest IDT)

Society of American Foresters. 1998. *The Dictionary of Forestry*. Edited by John A. Helms. 210 p. (Referred to as SAF)

Timber Staff is the Timber Staff on the Chattahoochee-Oconee NFs. (Referred to as Timber Staff)

USDA Forest Service, *Final Environmental Impact Statement for the Chattahoochee-Oconee National Forests Land and Resource Management Plan,* Southern Region, Supervisor's Office, Gainesville, GA, 1985. (Referred to as FEIS)

Forest Service Handbook (FSH) 2090.11, *Ecological Classification and Inventory Handbook*, WO Amendment 2090.11-91-1, Effective 4/26/91, 05 - Definitions. (Referred to as FSH 2090.11-05)

FSH 2409.13, *Timber Resource Planning Handbook*, WO Amendment 2409.13-92-1, Effective 8/3/92, 05 - Definitions. (Referred to as FSH 2409.13-05)

FSH 2409.15, *Timber Sale Administration Handbook*, Amendment No. 2409.15-96-2, Effective Sept. 19, 1996, 05 - Definitions. (Referred to as FSH 2409.15-05)

FSH 2409.17, Silvicultural Practices Handbook, 1/85 WO, Chapter 9 - Timber Stocking Guides and Growth Predictions, 9.05 - Definitions. (Referred to as FSH 2409.17-9.05)

FSH 2609.13, *Wildlife and Fisheries Program Management Handbook*, WO Amendment 2609.13-92-1, Effective 8/3/92, Chapter 70 - Analysis of Economic Efficiency of Wildlife and Fisheries Projects, 70.5 - Definitions. (Referred to as FSH 2609.70.5)

FSH 2709.12, *Road Rights-of-Way Grants Handbook*, 9/85 WO, Zero Code, 05 - Definitions. (Referred to as FSH 2709.12-05)

Forest Service Manual (FSM) 1900 - Planning, Amendment No. 1900-91-3, Effective March 15, 1991, 1905 - Definitions. (FSM 1905)

FSM 2060, Tuxen 1956 as cited in Mueller-Dombois and Ellenberg 1974, USDA Forest Service Ecosystem Management Coordination, Resource Information Group, <http://www.fs.fed.us/emc/rig/includes/section1.pdf>

FSM 2163, *Hazardous Waste Management*, Chapter 2163.05, Definitions. (Referred to as FSM 2163)

FSM 2200, *Range Management*, WO Amendment 2200-91-1 Effective 3/1/91, Chapter 2230, Grazing and Livestock Use Permit System, 2230.5 - Definitions. (Referred to as FSM 2230)

FSM 2300, *Recreation, Wilderness, and Related Resource Management*, Amendment No. 2300-91-3 Effective March 12, 1991. Chapter 2355, Off-Road Vehicle Use Management, Executive Order 116-44, as amended by Executive Order 11989, Use of Off-Road Vehicles on the Public Lands 37 FR 2877 (Feb. 9, 1972), 42 FR 26959 (May 25, 1977). (Referred to as FSM 2355)

FSM 2300, *Recreation, Wilderness, and Related Resource Management*, WO AFSM 2300 - Recreation, Wilderness, and Related Resource Management, WO Amendment 2300-90-1, Effective 6/1/90, Chapter 2310 - Planning and Data Management - 2312 - Recreation Information Management (RIM). (Referred to as (FSM 2312)

FSM 2400, Timber Management, WO Amendment 2400-96-6 Effective 9/24/96. Chapter 2435 - Salvage Sales. 2435.05, Definitions. (FSM 2435)

FSM 2500, *Watershed and Air Management*, Amendment No. 2500-94-4, Effective Dec. 20, 1994. Chapter 2520, Watershed Protection and Management. 2521 - Watershed Condition Assessment. 2521.05 - Definitions. (Referred to as FSM 2521)

FSM 2500, *Watershed and Air Management*, Amendment No. 2500-94-4, Effective Dec. 20, 1994. Chapter 2520, Watershed Protection and Management. FSM 2526 - Riparian Area Management. 2526.05 - Definitions. (Referred to as FSM 2526)

FSM 2600, *Wildlife, Fish, and Sensitive Plant Habitat Management*, Amendment No. 2600-91-8 Effective Oct. 22, 1991, Chapter 2605, Definitions. (Referred to as FSM 2605)

FSM 2600,*Wildlife, Fish, and Sensitive Plant Habitat Management*, WO Amendment 2600-95-7, Effective 6/23/95, Chapter 2670, Threatened, Endangered, and Sensitive Plants and Animals, 2670.5 - Definitions. (Referred to as FSM 2670)

A User's Guide to Forest Information Retrieval (FIR), Southeastern Forest Experiment Station, Forest Inventory and Analysis Unit, Asheville, NC, 1988. (Referred to as FIR)

Interim Resource Inventory Glossary, File 1900, Washington, DC, 96 p., June 14, 1989. (Referred to IRIG)

A

accessibility – The relative ease or difficulty of getting from or to someplace, especially the ability of a site, facility or opportunity to be used by persons of varying physical and mental abilities.

acid deposition – Rain, snow, or dry particulate matter containing high concentrations of acid anions (e.g. nitrate and sulfate), usually produced by atmospheric transformation of the byproducts of fossil fuel combustion. Precipitation with a pH lower than 5.0 is generally considered to be acidic.

acid neutralizing capacity – The total capacity of a water sample to neutralize acids, as deteremined by titration with a strong acid. Acid neutralizing capacity includes alkalinity (e.g. carbonate) plus base cations.

acidification – To convert into an acid or become acid.

Agriculture Conservation Program – USDA cost-share program for steambank improvement.

acquisition of land - Obtaining full landownership rights by donation, purchase, exchange, or condemnation.

acre-equivalents - The number of acres of forest habitat improved or affected by the installation of various wildlife habitat improvements in an area. Determined by multiplying by various coefficients.

acre-foot - A measurement of water volume, equal to the amount of water that would cover an area of 1 acre to a depth of 1 foot (specifically 43,560 cubic feet or 325,851 gallons).

activity - A measure, course of action, or treatment that is undertaken to directly or indirectly produce, enhance, or maintain forest and rangeland outputs or achieve administrative or environmental quality objectives.

adaptive management – A dynamic approach to forest management in which the effects of treatments and decisions are continually monitored and used, along with research results, to modify management on a continuing basis to ensure objectives are being met.

administrative unit - All the National Forest System lands where one forest supervisor has responsibility. The basic geographic management area within a Forest Service Region, station, or area.

advance regeneration (reproduction) - Seedlings or saplings that develop, or are present, in the understory.

aerial logging – A yarding system employing aerial means, (e.g., helicopters, balloons), to lift logs.

afforestation - Establishment of a forest or stand in an area not recently forested.

age class - A grouping of living things based on their age.

age class (cohort) - A distinct aggregation of trees originating from a single natural disturbance or regeneration cutting.

Age dependent relationships – Complex yield composite relationships between independent and dependent variables that vary by the age of the understory and/or the overstory.

agricultural land - Areas used primarily for production of food and/or fiber (excludes wood fiber). Examples include cropland, pasture, orchards, vineyards, nurseries, confined feeding areas, farmsteads, and ranch headquarters.

air pollution - Any substance or energy form (heat, light, noise, etc.) that alters the state of the air from what would naturally occur.

air quality class - Three broad classifications used to prevent significant deterioration of air quality for all areas of the country.

> **Class I -** All areas where essentially any degradation of air quality would be considered significant deterioration.
>
> **Class II -** All areas where moderate degradation over baseline concentrations are allowed.
>
> **Class III -** All others.

all aged stand – A stand with trees of all, or almost all age classes, including those of exploitable age.

allocated fund - Funds transferred from one agency or bureau to another for carrying out the purpose of the parent appropriation and agency.

allocation - The assignment of management prescriptions or combination of management practices to a particular land area to achieve the goals and objectives of the alternative.

allopatric – Condition where one species lives in a section of stream without other closely related species. The species have disjunct distributions. Opposite of sympatric.

allotment management plan - The basic land unit used to facilitate management of the range resource on National Forest System and associated lands administered by the Forest Service.

allowable sale quantity - The quantity of timber that may be sold from the area of suitable land covered by the Forest Plan for a time period specified by the Forest Plan. This quantity is usually expressed on an annual basis as the “average annual allowable sale quantity.”

all-terrain vehicle (ATV) - Any motorized, off-highway vehicle 50 inches or less in width, having a dry weight of 600 pounds or less that travels straddled by the operator. Low-pressure tires are six inches or more in width and designed for use on wheel rim diameters of 12 inches or less, utilizing an operating pressure of 10 pounds per square inch (psi) or less as recommended by the vehicle manufacturer.

alternative - In forest planning, a mix of resource outputs designed to achieve a desired management emphasis as expressed in goals and objectives, and in response to public issues or management concerns.

amendment - A formal alteration of the Forest Plan by modification, addition, or deletion. Forest Plan amendment requires an environmental analysis. Significant findings require an environmental impact statement and the amendment will follow the same procedure used for plan preparation. Insignificant findings allow the changes to be implemented following public notification. Amendments can take place at any time following plan approval.

amenity values - Features or qualities which are pleasurable or aesthetic, as contrasted with the utilitarian features of a plan, project, location, or resource.

analysis area - A collection of lands, not necessary contiguous, sufficiently similar in character, that they may be treated as if they were identical.

analysis area identifier - A resource characteristic used to stratify the land into capability areas and analysis areas.

Analysis of the Management Situation - A determination of the ability of the planning area to supply goods and services in response to society's demand. The AMS is contained in a 182-page report available from the Forest Supervisor. The Forest Plan includes a summary of the AMS. Information from it is contained throughout the EIS/Plan.

animal unit month - The quantity of forage required by one mature cow and her calf (or the equivalent, in sheep or horses), for one month; 682 pounds of air-dry forage.

annual forest program - The summary or aggregation of all projects that make up an integrated (multifunctional) course of action for a given level of funding of a forest planning area that is consistent with the Forest Plan.

annual work planning process - Preparation of technical plans that serve to implement land and resource management, and program decisions contained in the integrated land, resource plans, and budget allocations.

appropriated fund - Funds available for obligation or outlay by Congress to a given agency.

appropriate management response – The response to a wildland fire based on an evaluation of risks to firefighter and public safety. Circumstances under which the fire occurs, including weather and fuel conditions, natural and cultural resource management objectives, protection priorities, and values to be protected. The

evaluation must also include an analysis of the context of the specific fire within the overall logic, geographic area, or national wildland fire situation.

aquatic ecosystem - Components that include: the stream channel, lake and estuary beds, water, biotic community, and associated habitat features. Also included are streams and lakes with intermittently, semipermanently, and seasonally flooded channels or streambeds. In the absence of flowing water, intermittent streams may have pools or surface water.

aquatic habitat types - The classification of instream habitat based on location within channel, patterns of water flow, and nature of flow controlling structures. Habitat is classified into a number of types according to location within the channel, patterns of water flow, and nature of flow controlling structure. Riffles are divided into three habitat types: low gradient riffles, rapids, and cascades. Pools are divided into seven types: secondary channel pools, backward pools, trench pools, plunge pools, lateral scour pools, dammed pools, and beaver ponds. Glides, the third habitat type, are intermediate in many characteristics between riffles and pools. It is recognized that as aquatic habitat types occur in various parts of the country, additional habitat types may have to be described. If necessary, the regional fishery biologist will describe and define the additional habitat types.

arterial roads - Roads that provide service to large land areas and usually connect with public highways or other forest arterial roads to form an integrated network of primary travel routes. The location and standard are often determined by a demand for maximum mobility and travel efficiency rather than specific resource-management service. They are usually developed and operated for long-term land and resource management purposes and constant service. These roads generally serve areas more than 40,000 acres.

artificial regeneration (reproduction) - Creation of a new age class by renewal of a tree crop by direct seeding, or by planting seedlings or cuttings.

authorized use - Specific activity or occupancy, including a ski area, historical marker, or oil and gas lease, for which a special authorization is issued.

B

background - The area after the middleground in a picture or landscape; generally over 4 miles distance from the viewer.

bald - An early successional opening generally above 4,000 feet, characterized by grassy or heath vegetation.

basal area - The area of the cross-section of a tree inclusive of bark at breast height (4.5 feet or 1.37 meters above the ground) most commonly expressed as square feet per acre or square meters per hectare. Used to measure the density of a stand of trees. For shrubs and herbs it is used to determine phytomass. Grasses, forbs, and shrubs usually measured at or less then 1 inch above soil level. Trees—the cross-

section area of a tree stem in square feet commonly measured at breast height (4.5' above ground) and inclusive of bark, usually computed by using diameter at breast height (DBH), or tallied through the use of basal area factor angle gauge.

basal spray – The application of a pesticide, usually a herbicide for controlling brush or weed trees, directed at the base of the stem.

base sale schedule - A timber sale schedule formulated on the basis that the quantity of timber planned for sale and harvest for any future decade is equal to, or greater than, the planned sale and harvest for the preceding decade. The planned sale and harvest for any decade must not be greater than the long-term sustained yield capacity.

best management practice (BMP) - A practice, or a combination of practices determined to be the most effective and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

biodiversity - The variety of life in an area, including the variety of gene pools, species, plant and animal communities, ecosystems, and the processes through which individual organisms interact with one another, and their environments.

biological assessment - A "biological evaluation" conducted for major federal construction projects requiring an environmental impact statement, in accordance with legal requirements under Section 7 of the Endangered Species Act (16 U.S.C. 1536(c)). The purpose of the assessment and resulting document is to determine whether the proposed action is likely to affect an endangered, threatened, or proposed species.

biological evaluation - A documented Forest Service review of its programs or activities in sufficient detail to determine how an action or proposed action may affect any proposed, endangered, threatened, or sensitive species.

biological growth potential - The average net growth attainable on a fully-stocked natural forest land.

biological oxygen demand - Dissolved oxygen required by organisms for the aerobic biochemical decomposition of organic matter present in water.

bladed skid road - A travel way through the woods formed by loggers to facilitate dragging (skidding) logs from the stump to a log landing. Skid roads are generally used in steep terrain and are cut into mountainsides with a bulldozer.

board foot - A unit of timber measurement equaling the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide. Commonly, 1,000 board feet is written as 1 MBF, and 1,000,000 board feet is written as 1MMBF.

browse - Young twigs, leaves and tender shoots of plants, shrubs or trees that animals eat.

burning (prescribed) - The application of fire, usually under existing stands and under specified conditions of weather and fuel moisture, in order to attain silvicultural or other management objectives.

C

cable logging – A term for any system involving transport of logs along, or by means of steel cables with the load being lifted partly or wholly off the ground.

canopy cover - The percent of a fixed area covered by the crown of an individual plant species or delimited by the vertical projection of its outermost perimeter. Small openings in the crown are included. Used to express the relative importance of individual species within a vegetation community, or to express the canopy cover of woody species. Canopy cover may be used as a measure of land cover change or trend. Often used for wildlife habitat evaluations.

capability – The potential of a land area to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and a given level of management intensity. Note: capability depends upon the current condition and site conditions including climate, slope, land form, soil and geology, and the application of management practices and protection from fire, insects, and disease.

carrying capacity - The number of organisms of a given species and quality that can survive in, without causing deterioration of, a given ecosystem through the least favorable environmental conditions that occur within a stated interval of time.

channel ephemeral streams - Ephemeral streams that have a defined channel of flow where surface water converges with enough energy to remove soil, organic matter, and leaf litter. Ones that exhibit an ordinary high watermark and show signs of annual scour or sediment transport are considered navigable waters of the United States (USACE, Part 330- Nationwide Permit program, 2000).

channelization – Artificial change of a stream channel profile.

Clean Air Act of 1970 – A congressional act, along with the amendments passed in 1977 and 1990, that provides authority for the Environmental Protection Agency to develop specific regulations controlling air pollution.

cleaning - A release treatment made in an age class, not past the sapling stage, in order to free the favored trees from less desirable individuals of the same age class which can overtop them.

clearcutting - The harvesting in one cut of all trees on an area for the purpose of creating a new, even-aged stand. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as a separate age class in planning for sustained yield under area regulation. A method of regenerating an even-aged stand. Regeneration is from natural seeding, direct seeding, planted seedlings, and/or advance reproduction. Harvesting may be done in groups or patches (group or patch

clearcutting), or in strips (strip clearcutting). In the clearcutting system, the management unit or stand in which regeneration, growth, and yield are regulated consists of the individual clearcut stand.

clearcutting with reserves - A two-aged regeneration method in which varying numbers of reserve trees are not harvested to attain goals other than regeneration.

climax - The culminating stage in plant succession for a given environment with the vegetation having reached a highly stable condition.

closed road/trail – A road that is closed for public use.

co-dominant trees - Trees or shrubs with crowns receiving full light from above, but comparatively little from the sides. Crowns usually form the general level of the canopy.

cohort – a group of trees developing after a single disturbance, commonly consisting of trees of similar age, although it can include a considerable range of tree ages of seeding or sprout origin and threes that predate the disturbance.

cold water fishery - Aquatic habitats that predominately support fish species that have temperature tolerances up to about 70^{o}F, and exhibit their greatest reproductive success at temperatures below 65^{o}F (18.3^{o}C).

collector road - Roads that serve smaller land areas and are usually connected to a forest arterial or public highway. They collect traffic from forest local roads or terminal facilities. The location and standard are influenced by long-term multi-resource service needs, and travel efficiency. Forest collector roads may be operated for constant or intermittent service, depending on land-use and resource management objectives for the area served by the facility. These roads generally have two or more local roads feeding into them and generally serve an area exceeding 10,000 acres.

commercial forest land - Forest land that can produce crops of industrial wood, and has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service. Existing technology and knowledge must be available to ensure timber production without irreversible damage to soils productivity, or watershed conditions. Adequate restocking can be attained within five years after final harvesting.

commercial thinning – Any type of thinning producing merchantable material at least equal to the value of the direct cost of harvesting.

commercial tree species – (1) Tree species suitable for industrial wood produces. (2) Conifer and hardwood species used to calculate the commercial forest land allowable sale quality.

commodity outputs - A resource output with commercial value. All resource products that are articles of commerce.

compartment – A portion of a forest under one ownership, usually contiguous and composed of a variety of forest stand types, defined for purposes of locational reference.

composition (stand) - The proportion of each tree species in a stand expressed as a percentage of the total number, basal area, or volume of all tree species in the stand.

constraint - A restriction or limit that must be met.

Continuous Inventory of Stand Condition (CISE) - A system that continuously reflects an up-to-date description of timber stands. It tells what and when actions are planned for stands and gives some information about actions that have taken place. It is also the name of the data base management computer system used for the storage and retrieval of data.

Controlled Surface Use (CSU) - Use and occupancy is allowed (unless restricted by another stipulation), but identified resource values require special operational constraints that may modify the lease rights. CSU is used for operating guidance, not as a substitute for the NSO or Timing stipulation.

conventional logging - A term used to identify methods commonly used in an area to move logs from stump to mill.

conversion (forest management) – A change from one forest type to another in a stand on land that has the capability of both forest types.

coppice - A method of regenerating a stand in which all trees in the previous stand are harvested and the majority of regeneration is from stump sprouts or root suckers.

coppice with reserve - A two-aged regeneration method in which reserve trees are retained to goals other than regeneration. This method normally creates a two-aged stand.

cord - A unit of gross volume measurement for stacked, round wood based on external dimensions, generally implies a stack of 4 x 4 feet vertical cross section and 8 feet long. Contains 128 stacked cubic feet.

corridor - A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries. It can also be identified for wildlife habitat connecting, or protecting forest resources.

Council on Environmental Quality - An advisory council to the president established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the president on environmental matters.

creel survey – A survey of anglers.

critical habitat – Habitat, determined by the Secretary of Interior, essential to the conservation of the endangered or threatened species.

crown class - A class of tree based on crown position relative to the crowns of adjacent trees.

> **dominant -** Trees with crowns extending above the general level of the main canopy of even-aged groups of trees. They receive full light from above, and partly from the sides.
>
> **co-dominant -** Trees with crowns forming the general level of the main canopy in even-aged groups of trees. They receive full light from above, and comparatively little from the sides.
>
> **intermediate -** Trees with crowns extending into the lower portion of the main canopy of even-aged groups of trees, but shorter in height than the co-dominants. They receive little direct light from above, and none from the sides.
>
> **overtopped (suppressed) -** Trees of varying levels of vigor that have their crowns completely covered by the crowns of one or more neighboring trees.

cubic foot - A unit of measure reflecting a piece of wood 12 inches long, 12 inches wide, and 12 inches thick.

culmination of mean annual increment - Age at which average rate of annual tree growth stops increasing and begins to decline. Mean annual increment is expressed in cubic feet measure and is based on expected growth, according to the management intensities and utilization standards assumed in accordance with 36 CFR 219.16(a)(2)(i) and (ii). Culmination of mean annual increment includes regeneration harvest yields, and any additional yields from planned intermediate harvests.

cultural resources - Physical remains of districts, sites, structures, buildings, networks or objects that were used by humans. They may be historic, prehistoric, archaeological, architectural or spiritual in nature. Cultural resources are non-renewable.

cunit - Equivalent to 100 cubic feet of solid wood. Commonly, 100 cubic feet is expressed as 1 CCF.

cut-offs - Analysis constraints that prevent the valuation of non-timber outputs produced in excess of demand plus x percent. It ensures that the assumptions of a horizontal demand curve are not violated.

cutting cycle – The planned interval between partial harvest in a stand being managed with an uneven-aged regeneration method.

D

daylighting - The practices of cutting back edges of roads or trails by removing shrub and tree growth.

decision criteria - Rules or standards used to evaluate and rank alternatives.

den trees - Trees having rainproof, weather- tight cavities used by wildlife.

desired future condition - An expression of resource goals that have been set for a unit of land. It is written as a narrative description of the landscape as it will appear when the goals have been achieved. The condition also includes a description of physical and biological processes, the environmental setting, and the human experience.

Development Level **-** An indication of site modification based on classes in the Recreation Opportunity Spectrum. Development Level 1 equates to Primitive, with minimum site modification; 2 equates to Semi-Primitive Motorized/Nonmotorized, with little site modification; 3 equates to Roaded, with moderate modification; 4 equates to Rural, with heavy site modification; and 5 relates to Urban, with a high degree of site modification.

developed recreation - Recreation use or opportunities occurring at developed sites.

developed recreation site - A discrete place containing a concentration of facilities and services used to provide recreation opportunities to the public and evidencing a significant investment in facilities and management under the direction of an administrative unit in the National Forest System.

diameter at breast height – A tree's diameter measured at about 4.5 feet (1.37m) above the forest floor on the uphill side of the tree. For the purposes of determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

diameter class – Any of the intervals into which a range of diameters of tree stems may be divided for classification and use, (e.g., 10-inch class includes diameters from 9.5 inches to 10.49 inches.

dispersed recreation – Recreation opportunities or use occurring in the general forest area. Does not take place in developed sites.

disturbance (ecology) – Any relative discrete event in time that disrupts the ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment.

disturbance-recovery regime – A natural pattern of periodic disturbance followed by a period of recovery. Examples include fire or flooding.

diversity - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

drainage area/basin - The total area above a given point on a stream that contributes to the flow at that point. Term is often used interchangeably with watershed.

drum chopping - Method used to prepare areas for reforestation. Large drums with cutting blades attached are pulled over areas by vehicles that include crawler-type tractors and rubber-tired skidders.

E

early succession forest – The biotic community that develops immediately following the removal or mortality of most or all forest canopy, resulting in a predominance of woody species regeneration. As used in the Environmental Impact Statement and the Forest Plan, a stand age of 0 to 10 years defines this condition. See successional stage.

early-successional habitat – A vegetative condition typically characterized by low density to no tree canopy cover and an abundance of herbaceous and/or woody ground cover. This condition my include early-successional forest, maintained openings, pastures, and open woodlands.

early successional species - Plant or animal species characteristic of early forest successional stages.

ecological classification system - A hierarchical system used to help organize and coordinate the classification of ecological types, units, and to make comparisons. Classification is ecologically based and integrates existing resource data including climate, topography, geology, soil, hydrology, and vegetation. The system includes many levels (from the top-down approach): domain, division, province, section, subsection, land type, land type association, land type phase, and site.

ecological management unit - A grouping of one or more soil series that have similar characteristics including texture, structure, or water retention capacity. EMUs are used in soil mapping.

ecosystem - A complete interacting system of organisms and their environment.

ecosystem/cover type - The native vegetation ecological community considered together with non-living factors of the environment as a unit. The general cover type occupying the greatest percent of the stand location. Based on tree or plant species forming a plurality of the stocking within the stand. May be observed in the field, or computed from plot measurements.

electronic sites - Areas designated for the operation of equipment which transmits and receives radio signals.

endangered species - Any species that is in danger of extinction throughout all or a significant portion of its range, other than members of the class Insecta that have been determined by the Department of Interior to constitute a pest whose protection under the provisions of this (Endangered Species Act of 1973) act would present an overwhelming and overriding risk to humans. It must be designated in the *Federal Register* by the appropriate secretary.

Endangered Species Act of 1973 - An act that enables endangered and threatened species to be conserved. It provides a program for the conservation of such species, and takes appropriate steps to achieve the purposes of the (relevant) treaties and conventions.

endemic – Species restricted to a particular geographic area. Usually limited to one or a few small streams or a single drainage.

ending inventory - The standing volume at the end of the planning horizon. It must be adequate for the maintenance of long-term sustained yield.

environment - All the conditions, circumstances, and influences surrounding and affecting the development of an organism, or group of organisms.

environmental consequence - The result or effect of an action upon the environment.

Environmental Impact Statement - A disclosure document revealing the environmental effects of a proposed action, which is required for major federal actions under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review. Final Environmental Impact Statement (FEIS) is the final version of the statement disclosing environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act.

environmental impact - Used interchangeably with environmental consequence or effect.

ephemeral streams - Streams having flows that occur for short periods of time in direct response to storm precipitation or snowmelt runoff. Their bottoms are always above the water table and do not contain fish or aquatic insects that have larvae with multiple-year life cycles. Ephemeral streams may have a defined channel, but may be manifested as a natural swale or depression with vegetation and organic material covering the bottom. They also may serve as a conduit for much of the sediment that enters the stream system. Large woody debris associated with ephemeral streams may also contribute significantly to the stability of a stream system.
Ephemeral streams that exhibit an ordinary high watermark, show signs of annual scour or sediment transport, are considered navigable waters of the United States.

erosion - The wearing away of the land surface by the action of wind, water, or gravity.

essential habitat - Habitat in which threatened and endangered species occur, but which has not been declared as critical habitat. Occupied habitat or suitable unoccupied habitat necessary for the protection and recovery of a federally designated threatened or endangered species.

eutrophication – Condition of a lake where deleterious effects are caused by increased nutrients (nitrogen and phosphorous), and a decrease in oxygen.

evapo-transpiration - The transfer of water vapor to the atmosphere from soil and water surfaces (evaporation), and from living plant cells (transpiration).

even-aged methods – Regeneration methods designed to maintain and regenerate a stand with a single age class.

even-aged silvicultural system - A planned sequence of treatments designed to maintain and regenerate a stand with one age class.

even-aged stand - A stand of trees containing a single age class in which the range of tree ages is usually less than 20 percent of rotation.

Existing Old Growth - Individual stands currently recognized by the FS as meeting the parameters for existing old growth as described in the "Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region".

extirpation – Extinction of a species from all pr part of its range.

F

farmer-owned land - Owned by farm operators, excluding incorporated farm ownerships.

featured species - The selected wildlife species whose habitat requirements guide wildlife management including coordination, multiple use planning, direct habitat improvements, and cooperative programs for a unit of land. In context of land management planning, featured species are similar to management indicator species.

Federal Register - The designated document that notifies the public of federal actions and includes Notice of Intent, calls for public involvement, etc. It also publishes the regulations needed to implement those federal actions.

felling – The cutting down of trees.

final crop – That portion of the growing stock (to be) kept until final commercial harvest, (i.e., final product objective).

fire condition class – Based on coarse scale national data, classes measure general wildfire risk:

Class One – Fire regimes are usually within historical ranges. Vegetation composition and structure are intact. The risk of losing key ecosystem components from the occurrence of fire is relatively low.

Class Two – Fire regimes on these lands have been moderately altered from their historical range by increased or decreased fire frequency. A moderate risk of losing key ecosystem components has been identified.

Class Three – Fire regimes on these lands have been significantly altered from their historical return interval. The risk of losing key ecosystem components from fire is high. Fire frequencies have departed from historical ranges by multiple return intervals. Vegetation composition, structure and diversity have been significantly altered.

fire management effectiveness index - A measure of the effectiveness of annual fire management operational programs. Measured in dollars per thousand acres protected, the objective is to minimize the index value.

fire management plan – Strategic plans that define a program to manage wildland fires based on an area's approved land management plan. They must address a full range of fire management activities that support ecosystem sustainability, values to be protected, protection of firefighter and public safety, public health and environmental issues, and must be consistent with resource management objectives and activities of the area.

fire regime – A generalized description of the role a fire plays in the ecosystem. It is characterized by fire frequency, predictability, seasonality, intensity, duration, scale (patch size), and regularity or variability. Five combinations of fire frequency exist.

Groups One and Two include fire return intervals in the 0-35 range. One includes Ponderosa Pine, other long needle pine species, and dry site Douglas Fir. Group Two includes the drier grassland types - tall grass prairie, and some Pacific chaparral ecosystems.

Groups Three and Four include fire return intervals in the 35-100+ year range. Three includes interior dry site shrub communities including sagebrush and chaparral ecosystems. Group Four includes Lodgepole and Jack Pine.

Group Five is the long interval (infrequent), stand replacement fire regime and includes temperate rain forest, boreal forest, and high elevation conifer species.

fire use – The combination of wildland fire use and prescribed fire application to meet resource objectives.

fisheries classification - Water bodies and streams are classified as having cold, cool or warm water fishery.

fisheries habitat - Streams, lakes, and reservoirs that support fish.

floodplains - Lowland or relatively flat areas joining inland and coastal water including, at a minimum, that area subject to a 1-percent (100-year return period) or greater chance of flooding in any given year. Although floodplains and wetlands fall within the riparian area, they are defined here separately as described in the Forest Service Manual.

floor on first period production - The minimum harvest volume in the first period that should be produced to prevent a significant impact on the local economy.

forage - All browse and non-woody plants that are available to livestock or game animals used for grazing or harvested for feeding.

forage production - The weight of forage that is produced within a designated period of time on a given area. The weight may be expressed as green, air dry, or oven dry. The term may also be modified as to time of production including annual, current years, or seasonal forage production.

foreground - The area between the viewer and the middle ground in a landscape; generally from 0 to ½ mile distance.

forest - An area managed for the production of timber and other forest products, or maintained under woody vegetation for indirect benefits as protection of a watershed, recreation, or wildlife habitat.

forest type - A category of forest defined by its vegetation (particularly its dominant composition) as based on a percentage cover of trees.

forest development road - A road wholly or partly within, or adjacent to, and serving a part of the National Forest System. It also has been included in the Forest Development Road System Plan.

forest health – The perceived condition of a forest derived from concerns about factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance.

forest land - Land at least 10 percent occupied by forest trees of any size, or formerly having had such tree cover, and not currently developed for non-forest use. Lands developed for non-forest use including areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, adjoining road clearing, and power line clearing of any width.

Forest and Rangeland Renewable Resources Planning Act of 1974 - An act of Congress requiring the preparation of a program for the management of the national forests' renewable resources, and of land and resource management plans for units of the National Forest System. It also requires a continuing inventory of all National Forest System lands and renewable resources.

Forest Service Handbook (FSH) - A handbook that provides detailed instructions for proceeding with specialized phases of programs or activities for Forest Service use.

Forest Service Manual (FSM) - Agency manuals that provide direction for Forest Service activities.

forest trail system - Trails that are part of the forest transportation system. A designated path commonly used and maintained for hikers, horse riders, bicycles, or two-wheeled motorized vehicles.

forest type - A descriptive term used to group stands of similar composition and development because of given ecological factors, by which they may be differentiated from other groups of stands.

forest supervisor - The official responsible for administering the National Forest System lands in a Forest Service administrative unit. It may consist of two or more national forests or all the forests within a state. The supervisor reports to the regional forester.

forest-wide standard - A performance criterion indicating acceptable norms, specification, or quality that actions must meet to maintain the minimum considerations for a particular resource. This type of standard applies to all areas of the forest regardless of the other management prescriptions applied.

free-to-grow – A seedling or small tree free from direct competition from other trees, shrubs, grasses, or herbaceous plants.

fuel break - Any natural or constructed barrier used to segregate, stop, and control the spread of fire, or to provide a control line from which to work.

fuel treatment - The rearrangement or disposal of fuels to reduce fire hazard. Fuels are defined as living and dead vegetative materials consumable by fire.

fuels management - The planned treatment of fuels to achieve or maintain desired fuels conditions.

fuelwood - Wood used for conversion to some form of energy.

Future Old Growth - Areas on the Forest where development of old growth conditions are most likely to occur, based on the intent of the assigned management prescription.

G

game species - Any species of wildlife or fish for which seasons and bag limits have been prescribed, and which are normally harvested by hunters, trappers, and fishermen under state or federal laws, codes, and regulations.

General Forest Area - National forest lands not categorized as developed recreation sites, trails or wilderness. It can be a logical working area, (i.e., a drainage, geographic area, forest district, etc.) Typically containing a wide spectrum of settings and opportunities, facilities and sites located inside the boundary of a GFA are sometimes considered *concentrated use areas* (CUA), that may include dispersed

front- and/or backcountry campsites, parking areas, pullouts and landings, river and road corridors, lake surfaces, and day use areas including OHV areas, climbing areas, target shooting areas, etc. Amenities or constructed features inside GFAs are primarily for resource protection.

geologic features - Landforms or other features of significant geologic interest that may require special management to protect the special qualities, or provide interpretation to the public.

geologic formation - A mappable body of rock identified by distinctive characteristics, some degree of internal homogeneity, and stratigraphic position. The name normally consists of two parts. The first is the name of the geographic locality where the formation was first identified and described. This is followed by a descriptive geologic term, usually the dominant rock type.

Geographic Information System - An information processing technology to input, store, manipulate, analyze, and display spatial resource data to support the decision-making processes of an organization. Generally, an electronic medium for processing map information, typically used with manual processes to affect specific decisions about land base and its resources.

geological area - A unit of land that has been designated by the Forest Service as containing outstanding formations or unique geological features of the earth's development, including caves and fossils. Areas of this type and all other special interest areas are identified and formally classified primarily because of their recreational and educational values. Areas with similar types of values of scientific importance are formally classified as research natural areas.

global ranks – Ranks assigned by the Nature Conservancy and state heritage programs based on number of occurrences.

grassland - Areas on which vegetation is dominated by grasses, grass-like plants, forbs, and/or cryptogams (mosses, lichens, and ferns), provided these areas do not qualify as built-up land or cultivated cropland. Examples include tall grass and short grass prairies, meadows, cordgrass marshes, sphagnum moss areas, pasturelands, and areas cut for hay.

grazing - Consumption of range or pasture forage by animals.

grazing capacity - The maximum stocking rate possible without inducing damage to vegetation or related resources.

grazing permit - Official, written permission to graze a specified number, kind, and class of livestock for a specific period on a defined range allotment.

gross receipts - A total of all funds received by the U.S. Treasury as a result of Forest Service activities.

groundwater - Water in a saturated zone in a geologic stratum. Water stored below the water table where the soil (or other geologic material) is saturated.

group selection – An uneven-aged regeneration method in which trees are removed periodically in small groups. Uneven age classes for trees are established in small groups. The width of groups is about twice the height of the mature trees, with small opening providing microenvironments suitable for tolerant regeneration, and the larger openings providing conditions suitable for more intolerant regeneration.

growing stock trees - Live trees, meeting specified standards of quality or vigor, included in growth and yield projections to arrive at the allowable sale quantity.

growing stock volume - Volume (cubic feet) of solid wood in growing stock trees 5 inches DBH and larger, from a 1-foot stump to a minimum 4-inch top diameter, outside bark, on the central stem. Volume of solid wood in primary forks from the point of occurrence to a minimum 4-inch top diameter outside bark is included.

H

habitat - The native environment of an animal or plant.

harvest cutting – An intermediate for final cutting that extracts salable trees.

harvesting method - A procedure by which a stand is logged. Emphasis is on meeting logging requirements rather than silvicultural objectives.

herbicide – A pesticide used for killing or controlling the growth of undesirable plants.

high-grading - The removal from the most commercially valuable trees, often leaving a residual stand composed of trees of poor condition or species composition.

historic landscapes - Industrial, agricultural, pastoral or domestic landscapes that have evolved over many years from human alteration. Commonly functional and often vernacular, the landscapes may not always be visually pleasing, often responding to specific functions or topography, not formally planned or designed. They may be informal to the degree that they appear to be natural occurrences, or the spatial organization of built and natural elements may be quite traditional or formal. They are identifiable and can be mapped, either as point-specific features or enclaves within a larger landscape, as entire landscapes themselves, or as a combination of both.

human resource programs - Any of the federal labor programs providing work experience for local people.

hydric soils – Soils developed in conditions where soil oxygen is limited by the presence of saturated soil for long periods during the growing season.

I

Immediate Foreground- The area in the landscape from the viewer out to 300 feet distance.

improved pasture - Fenced, fertilized pastures intensively managed for livestock grazing.

improvement cutting – The removal of less desirable trees in a stand of poles or larger trees, primarily to improve composition and quality.

industrial fuelwood - Wood to be used specifically by industry for production of energy.

industrial wood - All commercial round wood products, except fuelwood.

infestation – The attack by macroscopic organisms in considerable concentration. Examples are infestations of tree crowns by budworm, timber by termites, soil or other substrates by nematodes or weeds.

INFRA Infrastructure - An integrated database for collection/storage/use of information about features, land units, facilities and utilities, accessibility and real property. For recreation management, INFRA holds information on O&M costs, recreation funding shortfalls, recreation use data, information on accessibility, and inventories of facilities. INFRA brings together Oracle, Arc Info and Arc View GIS technology, and supplements recreation management systems including SMS, ROS and Benefits Based Management.

initial attack – The aggressive response to a wildland fire based on values to be protected, benefits of response, and reasonable cost of response.

in-stream flow - The presence of adequate stream flow in channels necessary to maintain the integrity of the stream channel, and protection of downstream beneficial uses including fish and wildlife needs, outdoor recreation uses of water, and livestock watering needs.

integrated pest management (IPM) – The maintenance of destructive agents, including insects at tolerable levels, by the planned use of a variety of preventive, suppressive, or regulatory tactics and strategies that are ecologically and economically efficient and socially acceptable.

Interdisciplinary Team - A group of resource specialists (e.g.: forester, wildlife biologist, hydrologist, etc.) responsible for developing the Forest Plan/Environmental Statement, and for making recommendations to the forest supervisor.

intermediate treatments - A collective term for any treatment designed to enhance growth, quality, vigor, and composition of the stand after establishment of regeneration and prior to final harvest.

intermittent streams – Streams that flow in response to a seasonally-fluctuating water table in a well-defined channel. The channel will exhibit signs of annual scour, sediment transport, and other stream channel characteristics, absent perennial flows. Intermittent streams typically flow during times of elevated water table levels, and may be dry during significant periods of the year, depending on precipitation cycles.

interpretive association - A nonprofit, tax-exempt corporation or organization whose purpose is extending and enhancing the ability of the Forest Service to provide customer service to National Forest visitors. They work cooperatively with the Forest Service in educating the public about natural and cultural issues on public lands.

interpretive services - Visitor information services designed to present inspirational, educational, and recreational values to forest visitors in an effort to promote understanding, appreciation, and enjoyment of their forest experience.

intolerant – A plant requiring sunlight and exposure for establishment and growth.

L

land exchange - The conveyance of non-federal land or interests in the land in exchange for National Forest System land or interests in land.

landing – A cleared area in the forest to which logs are yarded or skidded for loading onto trucks for transport.

landline location - Legal identification and accurate location of national forest property boundaries.

land management planning – A formal process of management planning involving four interactive steps: monitoring, assessment, decision making, and implementations as described in the Federal Code of Regulations.

landscape - An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern that are determined by interacting ecosystems.

landscape character - Particular attributes, qualities, and traits of landscape that give it an image and make it identifiable or unique.

landtype - An intermediate level in the ecological classification system hierarchy that addresses land areas ranging in size from hundreds of acres up to ten thousands of acres. These units typically have similarities in landform, natural vegetative communities, and soils.

landtype association - A group of landtypes. The landtypes in the association are sufficiently homogeneous to be considered as a whole for modeling the future outputs and effects of planned management activities. Landtype associations may

not follow watershed boundaries, and are defined on the basis of general similarities in climate, geology, landform, and vegetation.

landtype phase - The most detailed level in the ecological classification system hierarchy that addresses local geology, soils, streams, and vegetation types. Land areas are generally less than 100 acres in size.

large woody debris (LWD) (coarse woody debris) (CWD) – Any piece(s) of dead woody material, e.g., dead boles, limbs, and large root masses, on the ground in forest stands, or in streams.

late- seral (successional) stage - The stage of forest development at which overstory trees have attained most of expected height growth and have reached ecological maturity. As used in the Environmental Impact Statement and the Forest Plan, this successional stage is generally defined by stand ages greater than 80 years for most hardwood types, and by stand ages greater than 60 years for most pine types. Old-growth forests occur during the later periods of this seral stage at ages that vary by forest type and in response to a variety of environmental conditions. See successional stage.

lease - A contract between the landowner and another granting the latter the right to search for and produce oil, gas, or other mineral substances (as specified in the document) on payment of an agreed rental, bonus, or royalty. This right is subject to the terms, conditions, and limitations specified in the document.

leave tree – A tree (marked to be) left standing for wildlife, seed production, etc, in an area where it might otherwise be felled.

Limits Of Acceptable Change (LAC) - A planning process used to establish acceptable wilderness resource and social conditions and prescribe appropriate management actions.

local road - Roads that connect terminal facilities with forest collector or forest arterial roads, or public highways. Forest local roads may be developed and operated for either long- or short-term service. These roads are generally single lane.

logging - The felling, skidding, on-site processing, and loading of trees or logs onto trucks.

long-term facilities - Facilities that are developed and operated for long-term land management and resource utilization needs. They may be operated for constant or intermittent service.

1. **constant service -** Facilities developed and operated for continuous or annual recurrent service.
2. **intermittent service -** Facilities developed and operated for periodic service and closed for more than one year between periods of use. Closure is by means other than a gate.

long-term sustained-yield capacity - The highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity, consistent with multiple-use objectives.

low PSI skidder - A term used to identify any one of several types of vehicles used to move logs from stump to log loading area. Low PSI (pounds per square inch) identifies those vehicles that, because of design of tracks, wheels, or suspension system, exert much lower pressure on ground surface than other types of ground-based skidding vehicles.

M

machine planting - A method by which tree seedlings are planted by mechanical means rather than by hand.

management action – A set of management activities applied to a land area to produced a desired output.

management action controls – Specifies the acreage or the proportion of an analysis unit assigned to a set of management actions. The controls can be specified in terms of greater than or equal to, equal to, or less than equal to some amount, or proportion of the analysis unit acreage.

management area - A selected grouping of capability or analysis areas selected through evaluation procedures used to locate decisions, and resolve issues and concerns. An area with similar management objectives, and a common management prescription.

Management Attainment Report (MAR) - A process used in determining whether work is progressing as planned. It provides the manager with information for measuring progress against objectives, information for measuring self and subordinates' performance, and an indication of a reporting unit's performance.

management concern - An issue, problem, or condition which constrains the range of management practices identified by the Forest Service in the planning process.

management direction - A statement of multiple-use and other goals and objectives. The associated management prescriptions, and standards and guidelines for attaining them.

management emphasis - The multiple-use values to be featured or enhanced.

management indicator species - A particular type of plant or animal whose presence in a certain location or situation is a sign or symptom that particular environmental conditions are also present. Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity.

management intensity - A management practice or combination of management practices and associated costs designed to obtain different levels of goods and services.

management opportunity - A statement of general actions, measures, or treatments that address a public issue or management concern in a favorable way.

management practice - A specific action, measure, course of action, or treatment undertaken on a forest.

management prescription - Management practices and intensity selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives.

management situation - A comprehensive statement of the planning area resources, its history as it may influence planning, past and present uses, and a review of the public issus directly concerned with the area.

management team – A decision-making group consisting of the forest supervisor, staff officers, and district rangers.

management type - The tree species or species group that should be grown on a specific site, whether or not it presently occupies the site that best suits the particular site soil, aspect, elevation, and moisture provided by the area and the forest plan's objectives.

mast tree - Generally hardwood trees of the heavy seeded variety including oaks, hickories, walnut, beech—25 years and older capable of producing frequent seed crops to feed a variety of wildlife species.

mature timber - The stage at which a crop or stand of trees best fulfills the main purpose for which it was grown.

maximum modification - A visual quality objective in which man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

mean annual increment of growth - The total increase in girth, diameter, basal area, height, or volume of individual trees or a stand up to a given age divided by that age.

mechanical site preparation - Soil disturbance by mechanical chopping, furrowing, dozing, or disking to prepare areas for reforestation. Objective is to reduce plant competition for trees to be planted.

mesic – Sites or habitats characterized by intermediate moisture conditions, i.e., neither decidedly wet or dry.

middle ground - The space between the foreground and the background in a picture or landscape; generally ½ mile to 4 miles distance from the viewer.

mid-serel (successional) stage – The stage of forest development during which distinct overstory, midstory, and understory canopies are developed. As used in the Environmental Impact Statement and the Forest Plan, this successional stage is generally defined as stand ages of 41-80 years for most hardwood types, and as stand ages of 21-60 ages for most pine types. See successional stage.

mineral exploration - The search for valuable minerals on lands open to mineral entry.

mineral soil - Weathered rock materials without any vegetative cover.

mineral resource - A known or undiscovered concentration of naturally occurring solid, liquid, or gaseous material in or on the earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible.

minerals (leasable) - Coal, oil, gas, phosphate, sodium, potassium, oil shale, sulphur, and geothermal steam. All hard-rock minerals that occur on acquired lands, as opposed to public domain lands, are leasable.

minerals (salable) - Common variety deposits that—although they may have value or use in trade, manufacture, the sciences, or in the mechanical or ornamental arts—do not possess a distinct, special economic value for such use over and above the normal uses of the general sum of such deposits. These may include sand, stone, gravel, pumicite, cinders, pumice (except that occurring in pieces more than two inches on a side), clay, and petrified wood.

minimum management requirement - Any constraint imposed to comply with 36 CFR 219.27 and other legal restrictions that must be met by benchmark solutions as noted in 36 CFR 219.11(e)(1). These include requirements including conserving soil productivity, maintaining minimum viable populations of wildlife, preserving the habitat of endangered species' habitat, dispersing openings, and limiting cut size. It also includes any other standards and guidelines, including best management practices that serve to define management prescriptions and resource response.

mitigation - Actions to avoid, minimize, reduce, eliminate, or rectify the impact of a management practice.

monitoring - The periodic evaluation on a sample basis of Forest Plan management practices to determine how fully objectives have been met, and how closely management standards have been applied.

montane – Relating to the zone of relatively moist, cool upland ;slopes characterized by the presence of large evergreen trees as a dominant life form.

mortality - Dead or dying trees resulting from forest fire, insect, diseases, or climatic factors.

motorized equipment - Machines that use a motor, engine, or other non-living power source. This includes, but is not limited to such machines as chain saws,

aircraft, snowmobiles, generators, motor boats, and motor vehicles. It does not include small battery or gas powered hand carried devices that include+ shavers, wristwatches, flashlights, cameras, stoves, or other similar small equipment.

multiple use - The management of all the various renewable surface resources of the National Forest System so that they are used in a manner that will best meet the needs of the American people. Making the most judicious use of the land for these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in the use to conform to changing needs and conditions.

multipliers - The ratio of a total impact to a component of the impact in input/output analysis. An example would be the ratio of the sum of direct, indirect, and induced impacts to direct impacts.

N

National Environmental Policy Act (NEPA) of 1969 - An act to declare a national policy that will encourage productive and enjoyable harmony between humankind and the environment. It was created to promote efforts that will prevent or eliminate damage to the environment, biosphere, and stimulate the health and welfare of humanity. In addition, the act was crafted to enrich the understanding of the ecological systems and natural resources important to the nation, and establish a Council of Environmental Quality.

National Forest Land and Resource Management Plan (Forest Plan) - A plan developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended, that guides all natural resource management activities and establishes management standards and guidelines for the National Forest System lands of a given national forest.

National Forest Management Act (NFMA) of 1976 - Act passed as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of regional guides and forest plans, and the preparation of regulations to guide them.

National Forest System (NFS) - All national forest lands reserved or withdrawn from public domain of the United States and acquired through purchase, exchange, donation, or other means. National Grasslands and land utilization projects administered under Title III of the Bankhead–Jones Farm Tenant Act (50 Stat. 525, 7 U.S.C. 1010–1012), and other lands, waters, or interests that are administered by the Forest Service, or are designated for administration through the Forest Service as a part of the system.

National Forest System Land - Federal land that has been legally designated as national forests or purchase units, and other land under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III land.

National Recreation Trails - Trails designated by the Secretary of the Interior or the Secretary of Agriculture as part of the national system of trails authorized by the

National Trails System Act. National recreation trails provide a variety of outdoor recreation uses, in or reasonably accessible, to urban areas.

National Register of Historic Places - The National Register of Historic Places is the Nation's official list of cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966,the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. Properties listed in the Register include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

National Visitor Use Monitoring (NVUM) - A systematic process to estimate annual recreation and other uses of National Forest lands through user surveys.

National Wild and Scenic Rivers System - Rivers with scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act of Oct. 2, 1968, for preservation of their free-flowing condition.

National Wilderness Preservation System - All lands covered by the Wilderness Act and subsequent wilderness designations, irrespective of the department or agency having jurisdiction.

natural regeneration - An age class created from natural seeding, sprouting, suckering, or layering.

net annual growth - The net change in merchantable volume expressed as an annual average between surveys in the absence of cutting (gross growth minus mortality).

net public benefits - An expression used to signify the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued. Net public benefits are measured by quantitative and qualitative criteria rather than a single measure or index. The maximization of net public benefits to be derived from management of units of the National Forest System is consistent with the principles of multiple use and sustained yield.

no-action alternative - The most likely condition expected to exist in the future if current management direction would continue unchanged.

non-chargable volume - All volume not included in the growth and yield projections for the selected management prescriptions used to arrive at the allowable sale quantity.

non-commodity output - A resource output that cannot be bought and sold.

non-declining yield - A level of timber production planned so that the planned sale and harvest for any future decade is equal to, or greater than the planned sale and harvest for the preceding decade.

non-forest land - Land that has never supported forests and lands formerly forested where use for timber utilization is precluded by development for other use. Lands that never have had, or that are incapable of having 10 percent or more of the area occupied by forest trees; or lands previously having such cover and currently developed for non-forest use.

non-game species - Any species of wildlife or fish which is ordinarily not managed or otherwise controlled by hunting, fishing, or trapping regulations. The designation may vary by state.

non-point source pollution – A diffuse source of pollution not regulated as a point source. May include atmospheric, deposition, agricultural runoff, and sediment from land-distributing activities.

non-stocked stands - Stands less than 16.7 percent stocked with growing stock trees.

non-timber forest products - All forest products except timber, including resins, oils, leaves, bark, plants other than trees, fungi, and animals or animal products.

No Surface Occupancy (NSO) - Use or occupancy of the land surface for mineral development is prohibited to protect identified resource values

O

objective - A concise, time-specific statement of measurable planned results that respond to pre-established goals. It forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

Off-Highway Vehicle (OHV) - Any vehicle capable of being operated off established roads; e.g., ATVs, motorbikes, four-wheel drives, and snowmobiles. (Also referred to as OHV or off-highway vehicle).

off-road vehicle (ORV) - Any motorized vehicle designed for or capable of cross county travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that term excludes (A) any registered motorboat; (B) any fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle\when used for national defense purposes; and (C) any vehicle whose use is expressly authorized by the respective agency head under a permit, lease, license, or contract.

offstream use – Water withdrawn or diverted from a ground or surface-water source for public water supply, industry, irrigation, livestock, thermoelectric power generation, and other uses.

old growth forests – An ecosystem distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics including tree size, accumulation of large dead woody material, number of canopy layers, species composition, and ecosystem function. Old growth is not necessarily virgin or primeval. It can develop over time following human disturbances, just as it does following natural disturbances. Old growth encompasses older forests dominated by early seral species, and forests in later successional stages dominated by shade tolerant species.

on-site - A term referring to species normally found on a site under natural conditions. The same or contiguous property that may be divided by a public or private right-of-way, provided that the entrance and exit between the properties is at a crossroads intersection, and that access is by crossing, as opposed to going along the right-of-way.

operating plan - A written plan, prepared by those engaged in mining activity on the forests, and approved by a forest officer for prospecting, exploration, or extraction activities that are slated to take place on National Forest System land.

ordinary high water mark - The line on the shore established by the fluctuation of water, and is indicated by physical characteristics including a clear, natural line impressed on the bank; shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter, debris, or other appropriate means that consider the characteristics of the surrounding area.

output - The goods, end products, or services that are purchased, consumed, or used directly by people. Goods, services, products, and concerns produced by activities that are measurable and capable of being used to determine the effectiveness of programs and activities in meeting objectives. A broad term for describing any result, product, or service that a process or activity actually produces.

output, minimum level - The amount of an output that will occur regardless of management activity.

outstanding mineral rights - Instances in which the minerals in federally- owned lands were severed prior to the transaction in which government acquired the land. Such rights are not subject to the Secretary of Agriculture's rules and regulations. Removal or extraction of these minerals must be allowed in accordance with the instrument severing the minerals from the surface and under applicable state and local laws and regulations.

overstory - That portion of trees in a two- or multi-layered forest stand that provides the upper crown cover.

overstory removal - The cutting of trees comprising an upper canopy layer in order to release trees or other vegetation in an understory.

P

PAOT - Persons-at-one-time; a measure of recreation carrying capacity, especially for developed sites. National conventions include 5 persons per family picnic/camp unit, 3.5 persons per parking lot stall at a trailhead or visitor center, 1.5 persons per motorcycle parking stall and 40 persons per tour bus parking stall.

partial retention - A visual quality objective which in human activities may be evident, but must remain subordinate to the characteristic landscape.

partnership - Voluntary, mutually beneficial and desired arrangement between the Forest Service and another or others to accomplish mutually agreed-on objectives consistent with the agency's mission and serving the public's interest.

payments in lieu of taxes - Payments to local or state governments based on ownership of federal land, and not directly dependent on production of outputs or receipt sharing.

per capita use - The average amount of water used person during a standard time period, generally per day.

perennial stream - Any watercourse that generally flows most of the year in a well-defined channel and is below the water table. Droughts and other precipitation patterns may influence the actual duration of flow. It contains fish or aquatic insects that have larvae with multi-year life cycles. Water-dependent vegetation is typically associated with perennial streams.

person-year - About 2,000 working hours that may be filled by one person working during the course of one year or several people working a total of 2,000 hours.

petrographic – The description and systematic classification of rocks.

physiographic region - A region of similar geologic structure and climate that has had a unified geomorphic history.

planning area - The area of the National Forest System covered by a regional guide or forest plan.

planning criteria - Standards, tests, rules, and guidelines by which the planning process is conducted, and upon which judgments and decisions are based.

planning horizon - The overall time period considered in the planning process that spans all activities covered in the analysis or plan. All future conditions and effects of proposed actions which would influence the planning decisions.

planning period - One decade. The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects, and benefits.

Possible Old Growth – areas with the highest probability of being existing or future old growth based on the preliminary inventory criteria as described in the "Guidance

for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region".

Potential Natural Vegetation - the biotic community that would become established if all successional sequences were completed without additional human interference under the present environmental conditions. Classifications of Potential Natural Vegetation are based on existing vegetation, successional relationships, and environmental factors (e.g., climate, geology, soil, natural disturbances, etc.) considered together.

pre-commercial thinning - The selective felling, deadening, or removal of tree in a young stand not for immediate financial return, but primarily to accelerate diameter increment on the remaining stems. To maintain a specific stocking or stand density range, or to improve the vigor and quality of the remaining trees.

prescribed fire – Any fire ignited by management actions to meet specific objectives including disposal of fuels, and controlling unwanted vegetation. The fires are conducted in accordance with prescribed fire plans, and are also designed to stimulate grasses, forbs, shrubs, or trees for range, wildlife, recreation, or timber management purposes.

present net value - The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area.

preservation - A visual quality objective that provides for ecological change only.

presuppression - Activities required in advance of fire occurrence to ensure effective suppression action, including: (1) recruiting and training fire forces, (2) planning and organizing attack methods, (3) procuring and maintaining fire equipment, and (4) maintaining structural improvements necessary for the fire program.

primary trout stream - Streams that contain naturally-reproducing populations of brook, rainbow, and/or brown trout.

primitive road - Roads constructed with no regard for grade control or designed drainage, sometimes by merely repeated driving over an area. These roads are single lane, usually with native surfacing and sometimes passable with four-wheel drive vehicles only, especially in wet weather.

process records - A system that records decisions and activities that result from the process of developing a forest plan, revision, or significant amendment.

proclamation boundary - The boundary contained within the presidential proclamation that established the national forest.

productive deferred - Productive (capable) forest land which has been legislatively designated or administratively designated by the Secretary of Agriculture or Chief of the Forest Service for wilderness study or possible additions to the Wilderness

System. This classification includes RARE II area designated as wilderness, but does not include RARE II areas designated as “further planning.”

productivity class - A classification of the capacity of a given piece of land for timber growth is expressed in cubic feet per acre a year.

Class I - Lands capable of producing 120 cubic feet or more per acre a year.

Class II - Lands capable of producing 85 to 119 cubic feet per acre a year.

Class III - Lands capable of producing 50 to 84 cubic feet per acre a year.

Class IV - Lands capable of producing 20 to 49 cubic feet per acre a year.

program - Sets of activities or projects with specific objectives, defined in terms of specific results and responsibilities for accomplishments.

program budget - The schedule of projects and activities to be carried out on the forest for a year for which funds have been appropriated.

program development and budgeting - The process by which activities for the forest are proposed and funded.

project - A work schedule prescribed for a project area to accomplish management prescriptions. An organized effort to achieve an objective identified by location, activities, outputs, effects, time period, and responsibilities for execution.

proposed action - In terms of the National Environmental Policy Act, the project, activity, or decision that a federal agency intends to implement or undertake. The proposed action described in the Environmental Impact Statement is the Forest Plan.

proposed wilderness – Areas recommended for wilderness by the Forest Service as a result of the RARE II study, but which have yet to be acted on by Congress.

prospecting permit - A written instrument or contract between the landowner and another conveying to the latter the right to enter the former’s property and search for mineral materials. Two types of permits are used: (1) a BLM Prospecting Permit is issued by the Bureau of Land Management upon recommendation of the Forest Service. In most cases, these are preference right permits in which the prospector has the first opportunity, to the exclusion of all others, to lease any minerals discovered, and (2) a Forest Service Prospecting Permit issued by the Forest Service. No preference rights are conveyed under Forest Service permits, except in some cases of common varieties on acquired lands.

public domain land - Original holdings of the United States that were never granted or conveyed to other jurisdictions or reacquired by exchange for other public domain lands.

public issue - A subject or question of widespread public interest relating to management of the National Forest System.

public participation activities - Meetings, conferences, seminars, workshops, tours, written comments, survey questionnaires, and similar activities designed or held to obtain comments from the general public and specific publics.

public roads - Roads across national forest land which were in place as public ways when these lands were acquired. These roads may be a part of the forest, state, or county system, and may be maintained by any of these agencies.

public supply – Water withdrawn by public and private water suppliers and delivered to users.

pulpwood - Wood cut and prepared primarily for manufacture into wood pulp.

pure stand - A stand composed of essentially a single tree species, conventionally at least 85 percent based on numbers, basal areas, or volumes.

Q

qualifiers – Measurable characteristics of outputs and activities. They characterize properties or attributes of activities or outputs.

R

raking - A term used in land clearing whereby crawler tractors, or other types of similar heavy equipment, with a large rake device attached to the front end, are used to push clearing debris into piles or windrows.

range allotment - A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under a range.

range management - The art and science of planning and directing range use to obtain sustained maximum animal production, consistent with perpetuation of the natural resources. Two types of range management are:

1. **extensive -** To control livestock numbers within present capacity of the range, but little or no attempt is made to achieve uniform distribution of livestock. Range management investments are minimal and only to the extent needed to maintain stewardship of the range in the presence of grazing. Past resource damage is corrected and resources are protected from natural catastrophes.

2. **intensive -** To maintain full plant vigor and to achieve full livestock utilization of available forage. This goal is achieved through implementation of improved grazing systems and construction and installation of range improvements. Cultural practices, (seeding and fertilizing), to improve forage quality and quantity may be used.

ranger district - Administrative subdivisions of the forest supervised by a District Ranger who reports to the Forest Supervisor.

rare species – Any native or once-native species of wild animal which exists in small numbers, and has been determined to need monitoring. May include peripheral species.

real dollar value - A monetary value, which compensates for the effects of inflation.

receipt shares - The portion of receipts derived from Forest Service resource management that is distributed to state and county governments, including the Forest Service, 25 percent fund payments.

reconstruction - Work that includes, but is not limited to, widening of roads, improving alignment, providing additional turnouts, and improving sight distance that improve the standard to which the road was originally constructed. Also undertaken to increase the capacity of the road or to provide greater traffic safety.

Record of Decision - A document separate from, but associated with an environmental impact statement that publicly and officially discloses the responsible official's decision on the alternative assessed in the environmental impact statement chosen to implement.

recreation - Leisure time activity including swimming, picnicking, camping, boating, hiking, hunting, and fishing.

Recreation alignment – To align or allocate the recreation resources (activities and opportunities) of an area with the niche and markets of the that area.

Recreation Capacity - A measure of the number of people a site can reasonably accommodate at one time; sometimes measured as PAOTs.

Recreation Opportunity Spectrum - A method for classifying types of recreation experiences available, or for specifying recreation experience objectives desired in certain areas. Classes are: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban.

- **Primitive ROS** An area characterized by having essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.

  The recreation experience opportunity level provided would be characterized by the extremely high probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsmen and outdoor skills in an environment that offers a high degree of challenge and risk.

- **Semi-Primitive Non-Motorized (ROS)** An area characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Interaction between users (or concentration of users) is low, but there is often evidence of other users. The area is managed in such a way that minimum

on-site controls and restrictions may be present but are subtle.

The recreation experience opportunity level provided would be characterized by the high, but not extremely high (or moderate) probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. (The opportunity to have a high degree of interaction with the natural environment.) Motorized use is not permitted.

- **Semi-Primitive Motorized (ROS)** An area characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Interaction between users (or concentration of users) is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but are subtle.

  The recreation experience opportunity level provided would be characterized by the high, but not extremely high (or moderate) probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. (The opportunity to have a high degree of interaction with the natural environment.) Motorized use is permitted.

- **Roaded Natural (ROS)** An area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.

  The recreation opportunity experience level provided would be characterized by the probability for equal experiencing of affiliation with individuals and groups and for isolation from sights and sounds of humans. Opportunities for both motorized and non-motorized forms of recreation may be provided.

- **Rural (ROS)** A classification for areas characterized by a substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil, but harmonize with the natural environment. A considerable number of facilities are designed for use by a large number of people. Moderate densities are provided away from developed sites. Facilities for intensified motorized use and parking are provided.

The recreation opportunity experience level provided would be characterized by the probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. These factors are generally more important than the setting. Opportunities for wildland challenge, risk taking, and testing of outdoor skills are generally unimportant.

- **Urban (ROS)** An area characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resources modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sound of humans, on-site, are predominant. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

  The recreation opportunity experience level provided would be characterized by the probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Experiencing natural environments, having challenges and risk afforded by the natural environment, and the use of outdoor skills are relatively unimportant. Opportunities for competitive and spectator sports and for passive uses of highly human-influenced parks and open spaces are common.

Recreation Visit - The entry of one person upon a National Forest to participate in recreation activities for an unspecified period of time. A NF visit can be composed of multiple site visits.

reforestation – The re-establishment of forest cover by seeding, planting, and natural means.

regeneration - The act of renewing of a tree crop by establishing young trees by naturally or artificially. The young crop itself.

regeneration cutting - Any removal of trees intended to assist regeneration already present or to make regeneration possible.

regeneration (reproduction) method - A cutting procedure by which a new age class is created. The major methods are clearcutting, seed-tree, shelterwood, selection, and coppice.

regeneration (reproduction) period - The time between the initial regeneration cutting and the successful re-establishment of a new age class by natural means, planting, or direct seeding.

Region 8 - The states that make up the Southern Region of the USDA Forest Service.

Regional Forester - The official responsible for management of National Forest land within a USDA Forest Service region.

regulated harvest – Includes any volume scheduled in calculations of the allowable sale quantity which is harvested from suitable forest land.

release and weeding – A silvercultural treatment designed to free desirable trees from competition with overstory trees, less desirable trees, or grasses and other forms of vegetative growth. It includes release of natural and artificial regeneration.

removal cut - The cut which removes the last seed bearers of a seed tree or shelterwood regeneration method after the new seedling stand is considered to be established.

research natural area - An area set aside by the Forest Service specifically to preserve a representative sample of an ecological community, primarily for scientific and educational purposes. Commercial exploitation is not allowed and general public use is discouraged.

reserve trees - Trees, pole-sized or larger, retained after the regeneration period under the clearcutting, seed-tree, shelterwood, or coppice methods.

reserved mineral rights - Refers to those cases wherein the minerals were severed from the surface during the transaction whereby the government acquired the land. These rights are subject to the Secretary of Agriculture's rules and regulations that were applicable at the time of the transaction.

resource - An aspect of human environment which renders possible, or facilitates the satisfaction of, human wants, and the attainment of social objectives.

resource allocation model - A mathematical model using linear programming that will allocate land to prescriptions and schedule implementation of those prescriptions simultaneously. The end purpose of the model is to find a schedule and allocation that meets the goals of the forest and optimizes some objective function including minimizing costs. The model used for this planning is called spectrum.

resource use and development opportunities - A possible action, measure, or treatment and corresponding goods and services identified and introduced during the scoping process. It may subsequently be incorporated into and addressed by the land and resource management plan in terms of a management prescription.

responsible line officer - The Forest Service employee who has the authority to select and/or carry out a specific planning action.

retention - A visual quality objective in which man's activities are not evident to the casual forest visitor.

revegetation - The re-establishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through the direct action of humans (e.g.: afforestation and range reseeding).

revision - To make the plan new or up-to-date. Plan revision must be considered and approved in accordance with the requirements for the development and approval of a forest plan. Revisions take place every 10-15 years, but may occur more frequently if conditions or public demands change significantly.

right-of-way - A right of use across the lands of others. It generally does not apply to absolute purchase of ownership. Land authorized to be used or occupied for the construction, operation, maintenance, and termination of a project or facility passing over, upon, under, or through such land.

riparian – Land areas directly influenced by water. They usually have visible vegetative or physical characteristics showing this water influence. Streamside, lake borders, and marshes are typical riparian areas.

riparian areas - Areas with three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width.

riparian corridor - An administrative zone applied to both sides of a stream or along side a pond, lake, wetland, seep or spring. It is a fixed width by stream type that may fall within or beyond the true riparian area.

riparian functions - Activities that occur in a riparian area without the influence of management activities. Functions include erosion and deposition by the streams, nutrient cycling, movement and storage of water, vegetative succession, etc.

ripping - A process where the soil is mechanically sliced or broken to improve tilth, aeration, and permeability.

river classifications (Wild and Scenic Rivers)

> (1) wild -- 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.
>
> (2) scenic -- 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.
>
> (3) Recreational -- Rvers 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.

road – A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified or temporary. (1) *Classified roads*. Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System

roads, and other road authorized by the Forest Service. (2) *Temporary Roads.* Roads authorized by contract, lease, other written authorization, or emergency operation not intended to be part of the forest transportation system and not necessary for long-term resource management. (3) *Unclassified Roads.* Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.

road - constant service - A facility on the transportation system developed and operated for long-term land management and resource utilization needs. It is also operated for continuous or annual recurrent service. System-open roads generally remain open for public use except for seasonal closures to prevent road damage due to bad weather conditions.

road - intermittent service - A facility on the transportation system that is developed and operated for long-term land management and resource utilization needs. It is operated for periodic service and closed for more than one year between periods of use. System-closed roads are generally built to access logging sites and are closed once logging activities are completed. They can be re-opened several years later, however, when access is once again needed to the site.

road closure - A technique used by management to regulate and control the use of facilities to achieve transportation economy, user safety, protection of the public investment, and accomplishment of forest resource objectives. It may be intermittent or long term.

road density - A measure of the total length of road in any given unit of area (e.g.: 4 miles/square mile.)

road maintenance levels - A formally established set of objectives that describes the conditions necessary to achieve the planned operation of a road. The levels vary from Level I, basic custodial care, to Level V, which is assigned high use roads in which user safety and comfort are important considerations.

roadless area - Undeveloped federal land within which there are no improved roads or roads maintained for travel by means of motorized vehicles intended for highway use.

Roadless Area Review and Evaluation (RARE) II - The assessment of “primitive” areas within the national forests as potential wilderness areas as required by the Wilderness Act documented in the final environmental impact statement of the Roadless Area Review and Evaluation, January 1979.

RARE II area - An area of land identified during the RARE II and the re-evaluation process as having potential for inclusion in the National Wilderness Preservation System.

RARE II inventory boundary - A boundary established with public input surrounding large areas of primarily Forest Service lands for the purpose of evaluation during the RARE II process. These lands meet minimum Forest Service criteria for potential wilderness.

rollover - A maximum PNV solution with an individual good or service production constrained at its maximum potential level. It provides an economically efficient basis for comparing all benchmark levels.

rotation - The number of years required to establish, including the regeneration period and grow timber crops, to a specified condition or maturity for harvest. Even- and two-aged management prescriptions in the Forest Plan use a rotation.

roundwood - Timber and fuelwood prepared in the round state - from felled trees to material trimmed, barked, and crosscut (e.g.: logs and transmission poles).

RPA Program - The recommended direction for long-range management of renewable resources of National Forest System lands. This direction serves as the basis for the regional targets assigned to the forest. The development of this direction is required by the Forest and Rangeland Renewable Resources Planning Act.

runoff - The total stream discharge of water from a watershed including surface and subsurface flow, but not groundwater. Usually expressed in acre-feet.

rural - A recreation opportunity spectrum classification for areas characterized by a substantially modified natural environment. Sights and sounds of man are evident. Renewable resource modification and utilization practices enhance specific recreation activities or provide soil and vegetative cover protection.

rural water use – Term used in previous water-use circulars to describe water used in suburban or farm areas for domestic and livestock needs. The water is generally self-supplied.

S

SAA – Southern Appalachian Assessment

sale schedule - The quantity of timber planned for sale by time period from an area of suitable land covered by a forest plan. The first period (usually a decade) of the selected sale schedule provides the allowable sale quantity. Future periods are shown to establish that long-term sustained yield will be achieved and maintained.

salmonids – Fish of the family salmon idea, the chars, trouts, salmons, and white fishes.

salvage cutting - The removal of dead trees or trees being damaged or killed by injurious agents other than competition. To recover value that would otherwise be lost.

sanitation cutting - The removal of trees to improve stand health and to reduce actual or anticipated spread of insects and disease.

sapling - A usually young tree that is larger than a seedling, but smaller than a pole. Size varies by region.

Savannas - An open area with trees covering less than 25 percent and with herbaceous species dominating.

sawtimber - Trees suitable in size and quality for producing logs that can be processed into dimension lumber.

scalloping - The undulating vegetative treatment given to a roadside for aesthetic purposes.

Scenery Management System - A system for the inventory and analysis of the aesthetic values of the National Forest Lands. It replaces the Visual Management System (VMS) as defined in Agricultural Handbook #462. The primary components of the SMS include: Landscape Character, Scenic Attractiveness, Existing Scenic Integrity, Concern Levels, Seen Areas, Scenic Classes, which are developed in the inventory. The Forest Plan components are Landscape Character Goals, Scenic Integrity Levels, Scenic Integrity Objectives, and Standards and Guidelines. These give management direction for the management areas.

National Forest land area is mapped as ecological sections or subsections but may be other land units. Landscape Character descriptions are developed for mapping Scenic Attractiveness, Class A-Distinctive, B-Typical, and C-Indistinctive areas. These help determine the high priority scenic areas. Existing Scenic Integrity Levels indicate the degree of intactness and wholeness of the existing landscape character. Very High Scenic Integrity Level is an unaltered landscape, High Scenic Integrity Level is a landscape that appears unaltered, Moderate Scenic Integrity Level is a landscape that is slightly altered, Low Scenic Integrity Level is a landscape that is moderately altered, Very Low Scenic Integrity Level is a landscape that is heavily altered, and Unacceptably Low Scenic Integrity Level is a landscape that is extremely altered.

Concern Levels are a measure of the degree of public importance placed on the landscape viewed from travel ways and use areas. Concern Levels reflect both the number of visitors and the interest of visitors in scenery. Concern Level 1 areas include primary recreation areas, very high use roadways, major roadways and trails through the forest, and places with moderate use where nearly all visitors are very concerned about scenery. Concern Level 2 areas include mostly secondary recreation areas, secondary roadways, trails, and places with moderate use and visitors with moderate interest in scenery. Concern level 3 travel ways and areas are those which receive very little use and/or use is primarily by visitors not concerned with scenery.

After Concern Levels are determined, the visibility of each area is mapped. Foreground is defined as up to ½ mile from the viewer, Middleground is ½ mile to 4 miles, and Background is over 4 miles from the viewer. The Seldom Seen areas are

also mapped.

Scenic Classes are determined by overlaying Scenic Attractiveness, Landscape Visibility, and Concern Level. The matrix in Table 4-2 page 4-16 from the SMS handbook is used. Scenic Class 1 scenery has extremely high public value, Scenic Class 2 scenery has very high public value, Scenic Class 3 scenery has high public value, Scenic Class 4 scenery has moderately high public value, Scenic Class 5 scenery has moderate public value, Scenic Class 6 scenery has moderately low public value, and Scenic Class 7 scenery has low public value. The Scenic Classes are used during the Forest planning process to compare the value of scenery to other resources.

Scenic Integrity Objectives (SIOs) and Landscape Character Goals are developed for Forest Plan Management Areas. Scenic Integrity Objectives are Very High-unaltered, High-appears unaltered, Moderate-slightly altered, and Low-moderately altered. The SIO that is assigned to a management area in the Forest Plan may be different than that of its existing Scenic Integrity Level indicating that any new management will meet the constraints of the assigned SIO.

Scenic Attractiveness - The scenic importance of a landscape based on human perceptions of the intrinsic beauty of landform, rockform, waterform, and vegetation pattern. Classified as A (Distinctive), B (Typical or Common), or C (Undistinguished).

Scenic Class - A system of classification describing the importance or value of a particular landscape or portions of that landscape. Values range from 1 (highest value) to 7 (lowest value).

scenic integrity objective - A desired level of excellence based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape. Objectives include Very High, High, Moderate, and Low.

Very High (VH) - Generally provides for only ecological changes in natural landscapes and complete intactness of landscape character in cultural landscapes.

High (H) - Human activities are not visually evident to the casual observer. Activities may only repeat attributes of form, line, color, and texture found in the existing landscape character.

Moderate (M) - Landscapes appear slightly altered. Noticeable human created deviations must remain visually subordinate to the landscape character being viewed.

Low (L) - Landscapes appear moderately altered. Human created deviations begin to dominate the valued landscape character being viewed but borrow from

valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed.

scoured channel - A definable channel of flow where surface water converges with enough energy to remove soil, organic matter, and leaf litter.

secondary processor - A mill that processes partially manufactured wood (a wood product such as chips or lumber), into a finished product. Examples include paper and furniture.

secondary trout streams - Streams that do not contain naturally-reproducing trout populations, but will sustain trout throughout the year. Populations must be maintained by stocking.

sediment - Solid mineral and organic material that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice.

seedling/sapling stands - Stands at least 16.7 percent stocked with growing stock trees, of which more than one-half of total stocking is seedlings and saplings.

seed tree – An even-aged regeneration method where in a single cut, the removal of all merchantable trees in a stand, except for a small number of widely dispersed trees retained for seed production, and to produce a new age class in a fully-exposed microenvironment.

seed-tree with reserves method - A two-aged regeneration method in which some or all of the seed trees are retained after regeneration has become established to attain goals other than regeneration.

seep - A wet area where a seasonal high water table intersects with the ground surface. Seeps that meet the definition of a wetland are included in the Riparian Corridor.

selected species - Species selected as indicators of the effects of management. Term is the same as management indicator species.

selection cutting - The removal of selected trees, particularly mature trees at planned intervals (cutting cycle), individually or in small groups, from an uneven-aged forest to realize the yield, and establish a new crop of desired tree species. Additionally, the tending of immature stand components are accomplished at each cutting cycle.

sensitive species - Those species that are placed on a list by the Regional Forester for which population viability is a concern. In this Region we generally use Natural Heritage rankings G1-3, N1-3, T1-3 or H, and USDI Fish and Wildlife Service candidates as a basis for developing the list.

sensitivity analysis - A determination of the consequences of varying the level of one or several factors while holding other factors constant.

sensitivity level - A particular degree or measure of viewer interest in the scenic qualities of the landscape.

sequential lower bounds - The maximum percent decrease in harvest volume in any decade as compared to the preceding decade. This prevents the forest from significantly decreasing its share of the market, which would violate the assumptions of the horizontal demand curve.

sequential upper bounds - The maximum percent increase in harvest volume in any decade as compared to the preceding decade. This prevents the forest from significantly increasing its share of the market, which would violate the assumptions of the horizontal demand curve.

shearing - A method used in land clearing whereby tree stems are severed at ground line by large bladed mechanisms mounted on crawler tractors (e.g.: serrated tooth V-blade or KG blade).

shelterwood - A regeneration method of regenerating an even-aged stand in which a new age class develops beneath the partially shaped microenvironment provided by the residual trees. The sequence of treatments can include three distinct types of cuttings: (1) an optional preparatory harvest to enhance conditions for seed production; (2) an establishment harvest to prepare the seed bed, and to create a new age class; and 3) a removal harvest to release established regeneration from competition with the overwood.

shelterwood with reserves - A two-aged regeneration method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other than regeneration.

short-term facilities - Facilities developed and operated for limited resource activity or other project needs. It will cease to exist as a transportation facility after the purpose for which it was constructed is completed, and the occupied land is reclaimed and managed for natural resource purposes.

silvicultural system - A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop, and provide for regeneration and according to the type of forest thereby produced.

silviculture - The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands. Silviculture entails the manipulation of forest and woodland vegetation in stands and on landscapes to meet the diverse needs and values of landowners and society on a sustainable basis.

silvics – The study of the life history and general characteristics of forest trees and stands, with particular reference to environmental factors, as a basis for the practice of silviculture.

single-tree selection - A regeneration method of creating new age classes in uneven-aged stands in which individual trees of all size classes are removed uniformly throughout the stand to achieve desired stand structural characteristics.

site - An area in which a plant or stand grows, considered in terms of its environment, particularly as this determines the type and quality of the vegetation the area can carry.

site class - A classification of site quality, usually expressed in terms of ranges of dominant tree height at a given age or potential mean annual increment at culmination.

site preparation - The preparation of the ground surface prior to reforestation. Various treatments are applied as needed to control vegetation that will interfere with the establishment of the new crop of trees or to expose the mineral soil sufficiently for the establishment of the species to be reproduced.

site index – A series-specific measure of actual or potential forest productivity (site quality, usually for even-aged stands), expressed in terms of the average height of trees included in a specified stand component (defined as a certain number of dominants, codominants, or the largest and tallest trees per unit area) at a specified index or base age.

site productivity class - A species-specific classification of forest land in terms of inherent capacity to grow crops of industrial, commercial wood. Usually derived from the site index.

site quality (productivity) - The productive capacity of a site, usually expressed as volume production of a given species.

skid trails - A travel way through the woods formed by loggers dragging (skidding) logs from the stump to a log landing without dropping a blade and without purposefully changing the geometric configuration of the ground over which they travel.

skidding - A term for moving logs by dragging from stump to roadside, deck, or other landing.

slash - The residue left on the ground after felling, silvicultural operations, or as a result of storm, fire, girdling, or poisoning. All vegetative debris resulting from the purchaser's operations. Slash associated with construction of roads is subject to treatment according to construction specifications, all other is subject to the terms of contract provision B/BT6.7.

snag - A dead or partially dead (more than 50 percent) hardwood or pine tree which is used by many bird species for perching, feeding, or nesting.

social analysis - An analysis of the social (as distinct from the economic and environmental) effects of a given plan or proposal for action. It includes identification and evaluation of all pertinent desirable and undesirable consequences to all segments of society, stated in some comparable quantitative terms, including persons or percent of population in each affected social segment. In addition, social analysis also includes a subjective analysis of social factors not expressible in quantitative terms.

soil enhancement - Application of methods or materials to the soil to increase its productivity and stimulate growth of vegetation.

soil productivity - The inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Soil productivity may be expressed in terms of volume or weight/unit area/year, percent plant cover, or other measures of biomass accumulation.

soil survey - A term for the systematic examination of soils in the field and in laboratories; their description and classification; the mapping of kinds of soil; the interpretation of soils according to their adaptability for various crops, grasses, and trees; their behavior under use of treatment for plant production or for other purposes; and their productivity under different management systems.

soil and water resource improvement - The application of preplanned treatment measures designed to favorably change conditions of water flow, water quality, rates of soil erosion, and enhancement of soil productivity.

southern pine beetle - One of the many species of pine bark beetles that are present in the forest at all times. When environmental and forest conditions become favorable, the beetle populations can increase and cause substantial timber losses over extensive areas in a relatively short period of time.

spatial feasibility testing - A process for verifying on a sample basis that land allocation and scheduling is actually implementable on the ground.

special concern species – Species that is federally listed as Category 2 or ranked as globally rare by state heritage programs and The Nature Conservancy. Also used by some states for any species of wild animal native or once-native to the state which is determined by the state to require monitoring.

special-use authorization - A permit, term permit, or easement that allows occupancy, use, rights, or privileges of National Forest System land.

special use permit – A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest land for some special purpose.

splash dams – Dams, usually temporary, built of wood across mountain streams to pond up large amounts of water.

spring - A water source located where water begins to flow from the ground due to the intersection of the water table with the ground surface. Generally flows throughout the year. Springs that are the source of perennial or intermittent streams are included in the Riparian Corridor.

stand - A contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.

stand density - A quantitative measure of stocking expressed either absolutely per unit of land in terms of number of trees, basal area, volume per unit area, or relative to some standard condition.

stand improvement - A term comprising all intermediate cuttings made to improve the composition, structure, condition, health, and growth of even-aged, two-aged, or uneven-aged stands.

standard - Requirement that precludes or imposes limitations on resource management practices and uses. Usually for resource protection, public safety, or addressing an issue.

state, county, and municipal land - Land owned by states, counties, and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

stocking - The degree of occupancy of land by growing stock trees, measured by basal area or number of trees per unit area and spacing compared with a minimum standard - which varies by tree size and species or species group - to the occupancy that is required to fully utilize the growth potential of the land.

stratified mixture - A stand in which different tree species occupy different strata of the total crown canopy.

stratigraphic – Pertaining to strata or layers, as in a description of layers of rock types.

stratum (canopy layer) - A distinct layer of vegetation within a forest community.

Streamside Management Zones - Land areas adjacent to natural streams, lakes, ponds, and seeps. These zones are typically designed to reduce, minimize or prevent non-point source pollution from entering a stream system (e.g.: sediment from a road or timber harvesting activity). Specific SMZ buffer widths are often defined in State Best Management Practice handbooks.

stressors – Pressure or change brought upon an ecosystem by pollution sources including sediment, contaminants, and toxins.

successional stage - A period, marked by distinctiveness of structure, in the development of a forest community from establishment of tree regeneration to

advanced age. In general, successional stages used in the Environmental Impact Statement and the Forest Plan are defined in terms of forest age as a surrogate measure of the distinct structure at each stage *generally* as follows:

Stage	Pine Types	Hardwood Types
Early	0 – 10 years old	0 – 10 years old
Sapling/Pole	11 – 20 years old	11 – 40 years old
Mid	21 – 60 years old	41 – 80 years old
Late	61+ years old	81+ years old

For a complete discussion of the ages within the different successional stages/forests by forest community type, refer to the process record titled Forest Community Types and Forest Successional Classes for National Forests in the Southern Appalachian Plan Revisions.

suitability - The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

suitable forest land - National Forest System land allocated by a Forest Plan decision to be managed for timber production on a regulated basis. *Regulated basis* means a systematic relationship between tree growth and timber harvest such that a specific timber volume objective level can be sustained indefinitely.

supply - The amount of a good or service that producers are willing to provide at a specified price, time period, and conditions of sale.

surficial water - Water on or at the ground surface. Does not include ditches, canals, spillways, or other human-created flow channels.

sustained yield of the products and services - The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the National Forest System without impairment of the productivity of the land.

sympatric – Condition where two or more closely related species live together n the same section of stream. The species have overlapping distributions. Opposite of allopatric.

T

targets - Objectives assigned to the forest by the Regional Plan.

taxomic – Classification of organisms into categories according to their natural relationships.

temporary roads - These are low standard, generally single use facilities to access an area with no permanent road access. The road is authorized by contract, permit,

lease, or other written authorization, or for emergency operations. The road is not part of the forest transportation system and is not necessary for long-term resource management. The road is for non-recurrent use and the location will be restored to near original condition after use by seeding or tree planting. Any cutting, filling or culverts should be removed as part of restoration. The road location should be sufficiently blocked to not allow any continued use by vehicular traffic.

tentatively suitable forest land - National Forest System land that meets specific criteria in the implementing regulations of the National Forest Management Act (36 CFR 219.14 for further consideration during the planning process for timber production on a regulated basis. Note that “tentatively suitable land” is not the same as the allocation of the existing Forest Plan, as amended since 1985, but is identified by a reanalysis. (Also called “Phase 1 suitability” or “Stage 1 suitability” because its designation as Part “A” of a three-part process described by the text of the National Forest Management Act.) (Timber Supply/Demand).

term permit - A special-use authorization to occupy and use National Forest System land, other than rights-of-way, for a specified period. It is revocable and compensable according to its terms.

theming – A land and/or management scheme created with the list of land and/or management.

thermoelectric power water use – Water used in the process of the generation of thermoelectric power.

thinning - A cutting made to reduce stand density of trees primarily to improve growth, enhance forest health, or to recover potential mortality.

thinning interval - The period of time between successive thinning entries, usually used in connection with even-aged stands.

threatened species - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Designated as a threatened species in the *Federal Register* by the Secretary of Interior.

tiering – A National Environmental Policy Act term used to reference the coverage of general matters in broader environmental impact statements (including national program or policy statements), with subsequent narrower statements or environmental analyses (including regional or basinwide program statements or ultimately site-specific statements), incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared.

timber - Wood retaining many of the recognizable characteristics of a tree: round, bark covered, and tapering, but without the limbs and leaves. In wood-industry usage, it may be “standing timber”- that portion of living trees with characteristics of value to

the wood-using industry, or cut trees not yet processed beyond removing limbs and tops.

timber demand - A relationship between stumpage or delivered log price and the quantity of timber produced.

timber product market area - The geographic area enclosed within a polygon drawn by connecting those mills buying forest timber that are the farthest away from the forest.

timber production - The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of forest planning, timber production does not include the production of fuelwood or harvests from unsuitable lands.

timber removals (drain) - The merchantable volume of trees removed from the inventory by harvesting, cultural operations including stand improvement, land clearing, or changes in land use expressed as an annual average between surveys. Within national forests, removals are almost all timber harvest except that the inventory on lands withdrawn by legislative action is also normally accounted for as "removals."

timber sale program quantity - The volume of timber planned for sale during the first decade of the planning horizon. It includes the allowable sale quantity (chargeable volume), and any additional material (non-chargeable volume), planned for sale. The timber sale program quantity is usually expressed as an annual average for the first decade.

timber stand improvement - A term comprising all intermediate cuttings made to improve the composition, constitution, condition, and increment of a timber stand.

timber supply - The amount of wood raw material available to be harvested within specified parameters of time and geographic area.

timberland - Forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of industrial wood crops under natural conditions. Not withdrawn from timber utilization, and not associated with urban or rural development. Currently, inaccessible and inoperable areas are included.

tolerance - The ability of a tree to grow satisfactorily in the shade of, and in competition with, other trees.

topography - The configuration of a land surface including its relief, elevation, and the position of its natural and human-made features.

toxicity index profile – Estimate of cumulative potential for toxic impacts in water.

trailheads - The parking, signing, and other facilities available at the terminus of a trail.

traffic service levels – Describe a road's significant traffic characteristics and operating conditions.

transfer age – The age a stand will transfer from one Model 2 management class to another.

transfer class – A Model 2 management class that receives transferred acres. A regeneration transfer class has a transfer age of zero. All other transfer classes have an age greater than zero.

transfer columns – A column constructed the matrix generator to create special LP structures. They accumulate information from several decision variables into one column.

two-aged silvicultural system - A planned sequence of treatments designed to maintain and regenerate a stand with two age classes.

two-aged stand - A stand composed of two distinct age classes that are separated in age by more than 20 percent of rotation.

type conversion - A change from tree species or species group to another. An example is a change from hardwoods to pine.

U

undercutting (root pruning) - The root pruning of seedlings in a nursery bed.

understory - The trees and other vegetation growing under a more or less continuous cover of branches and foliage formed collectively by the upper portion (overstory) of adjacent trees and other woody growth.

uneven-aged regeneration methods - Methods of regenerating a forest stand, and maintaining an uneven-aged structure by removing some trees in all size classes either singly, in small groups, or strips. The methods are single-tree or group selection.

uneven-aged silvicultural system - A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes.

universal soil loss equation - An equation used to estimate soil erosion rates and for the design of water erosion control systems. A = RKLSPC wherein A = average annual soil loss in tons per acre per year; R = rainfall factor; K = soil erodibility factor, L = length of slope; S = percent of slope; P = conservation practice factor; and C = cropping and management factor.

unregulated forest - Commercial forest land that will not be organized for timber production under sustained-yield principles.

unsuitable forest land (not suited) - Forest land not managed for timber production because: (a) Congress, the Secretary [of Agriculture], or the Chief [of the

Forest Service] has withdrawn it; (b) it is not producing or capable of producing crops of industrial wood; (c) technology is not available to prevent irreversible damage to soils productivity, or watershed conditions; (d) there is no reasonable assurance based on existing technology and knowledge, that it is possible to restock lands within five years after final harvest, as reflected in current research and experience; (e) there is, at present, a lack of adequate information about responses to timber management activities; or (f) timber management is inconsistent with, or not cost efficient in meeting the management requirements and multiple-use objectives specified in the Forest Plan.

urban – An area characterized by a substantially urbanized environment. The background may have natural-appearing elements.

utilization standards - Measurements for standing trees that describe the minimum size tree that will be designated for sale for various products including sawtimber or small roundwood.

V

values, market - Prices of market goods and services measured in real dollars in terms of what people are willing to pay as evidenced by market transactions.

values, non-market - Prices of non-market goods and services imputed from other economic values.

vector – A matrix composed of only one row or column.

viable population - Population of plants or animals that has the estimated numbers and distribution of reproductive individuals to ensure its continued existence is well distributed in the planning area.

viewshed - The total landscape seen, or potentially seen from all or a logical part of a travel route, use area, or water body.

visual quality objective - A desired level of excellence based on physical and sociological characteristics of an area under the Visual Management System. Refers to the degree of acceptable alterations of the characteristic landscape. Objectives include Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The Visual Management System (VMS) as defined in Agricultural Handbook #462 and was replaced by the Scenery Management System.

visual resource - The composite of basic terrain, geological features, water features, vegetative patterns, and land-use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

W

warm water fishery - Aquatic habitats that support fish species which have their best reproductive success and summer water temperature tolerance between 75 and 85 degrees Fahrenheit (23-29 C), or about 80 degrees Fahrenheit. Examples include sunfish species, and largemouth bass.

water supply area - Areas that serve present and future municipal water supply and trout hatching or rearing operations.

water yield - The measured output of the forest's streams expressed in acre-feet. The amount or volume of water that flows in a given period of time from a watershed.

waterbars - A change in the grade of a roadbed, trail surface, or fire line used to divert water off the surface to prevent it from eroding ruts and possibly carrying sediment to a stream.

watershed - The total area above a given point on a stream that contributes water to the flow at that point.

Weeks Act – Implemented in 1911, it authorized the acquisition of lands on the watershed of navigable streams for the purposes of conserving their navigability, or for the purpose of timber.

wetlands - (pursuant to the Federal Clean Water Act) - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances, support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas, and are found primarily within palustrine systems; but may also be within riverine, lacustrine, estruarine, and marine systems.

wild and scenic river - A river selected for nomination and/or designation through the Wild and Scenic Rivers Act of 1968 for possessing outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values.

wilderness - A Congressionally-designated area that is part of the National Wilderness Preservation System established through Wilderness Act of 1964; Also defined in the Act as a wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this chapter an area of underdeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an

unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

Wilderness Act of 1964 – Act which gave Congress authority to designate certain areas of public land as wilderness. It established the National Wilderness Preservation System to secure an enduring resource of wilderness.

wilderness study area - One of the areas selected by the Chief of the Forest Service from an inventory of undeveloped National Forest System lands as having apparent high qualities for wilderness. Lands possessing the basic characteristics of wilderness and designated by Congress for further wilderness study. A study can determine whether they should be recommended for addition to the National Wilderness Preservation System.

wildland fire - Any non-structural fire on wildlands other than one intentionally set for management purposes. Confined to a predetermined area. Not to be confused with "fire use,"which includes prescribed fire.

wildland urban interface – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

wildlife - All non-domesticated mammals, birds, reptiles, and amphibians living in a natural environment, including game species and non-game species. Animals, or their progeny (i.e., feral animals - including horses, burros, and hogs), that once were domesticated, but escaped captivity, are not considered wildlife.

wildlife and fish user-day – A 12-hour participation in the use of wildlife and fish primarily for consumptive or non-consumptive use including hunting, fishing, or wildlife viewing. Such use is the result of habitat management, and the populations supported by that habitat. A WFUD is counted as one day or any part of a day that the user participated in these activities. Does not include sport or commercial uses of anadromous fish.

wildlife habitat diversity - The distribution and abundance of different plant and animal communities and species within a specific area.

wildlife habitat improvement - The manipulation or maintenance of vegetation to yield desired results in terms of habitat suitable for designated wildlife species or groups of species.

wildlife tree - A den tree, snag, or mast or food tree.

with-without comparison - An evaluation that compares outputs, benefits, costs, and other effects with a base alternative.

withdrawl – Water removed from the ground or diverted from a surface water source for use.

withdrawal of land - An order removing specific land areas from availability for certain uses.

withdrawn national forest lands - National Forest System lands segregated or otherwise withheld from settlement, sale, location, or entry under some or all of the general land laws.

Woodlands - An open stand of trees with crowns not usually touching (generally forming a 25 to 60 percent cover).

woodland grazing - Grazing livestock on the grass-forbs existing under forested stands, mainly southern yellow pine types.

wrenching - The disturbance of seedling roots in a nursery bed (e.g.: with a tractor-drawn blade), with the objective of stimulating the development of a fibrous root system.

X

xeric – Pertaining to sites or habitats characterized by decidedly dry conditions.

Y

yarding - A term used to describe operations used to move logs from stump to point where logs are loaded for transport to mill. Most commonly used in cable logging operations.

yield composite – Activity and output relationships which estimate yields. They allow the development of a yield stream from a related yield stream without entering each yield coefficient independently. Yield composite relationships can be time, age, or sequence based.

yield stream – A subset of a yield table containing specific information for an activity or output. A timber output may have a yield stream for amount, diameter, basal area, or trees.

yield table - A tabular statement of outputs expected to be produced under a specific set of conditions.

Z

zone – Large, contiguous areas of land that include watersheds or management areas. It can be comprised of several complete analysis units. The land within a zone is generally a heterogenous mixture of environmental types.

zone management actions – Management actions available to zones. They contain the ability to coordinate the management activities that occur within a zone.

REFERENCES

A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment. 10-year Comprehensive Strategy. August 2001.

Abell, R.A., D.M. Olson, E. Dinerstine, P.T. Hurley, J.T. Diggs, W. Eichbaum, S. Walters, W. Wettengel, T. Allnutt, C.J. Loucks, and P. Hedao. 2000. Freshwater ecoregions of North America: a conservation assessment. Island Press, Washington, D.C.

Achtermeier, G.L., Kennard, D.K., Stanturf, J.A., Wade, D.W., and Waldrop, T.A. 2002 Fire in Southern Forest Landscapes Southern Research Station USDA Forest Service.

Ackermann, W.S. 1966. Guidelines for Research on Hydrology of Small Watersheds. Office of Water Resources Research. U.S. Dept. of Interior. Washington, D.C. 26 pp.

Adams, T. 1994. Implementation Monitoring of Forestry Best Management Practices on Harvested Sites in South Carolina. South Carolina Forestry Commission. Columbia, South Carolina. 24 p.

Adams, T. 1996. Implementation Monitoring of Forestry Best Management Practices for Site Preparation in South Carolina. South Carolina Forestry Commission. Columbia, South Carolina. 24 p.

Adams, T. and D. Hook. 1993. Implementation and Effectiveness Monitoring of Forestry Best Management Practices on Harvested Sites in South Carolina. South Carolina Forestry Commission. Columbia, South Carolina. 32 p.

Adkins, Jenny, 1995. Freshwater Mussels of the Chattooga River. US Forest Service with NRCS cooperating. Published abstract at SAMAB Conference in 1995.

Air Resource Specialists. 1995. Historical data summaries and permanent photographic archive for Shining Rock Wilderness, North Carolina. 1988 – 1992. Fort Collins, Colorado.

Alderman, J. 1995. Freshwater Mussel Inventory of the Stevens Creek Subasin, Long Creek Ranger District, Sumter National Forest, South Carolina. Final Report in fulfilment of a Challenge Cost Share Agreement with the Francis Marion and Sumter National Forest, Columbia, SC.

Alderman, J. 1998. Survey for the Endangered Carolina Heelsplitter (*Lasmigona decorata*) in South Carolina. Final Report in fulfilment of a contract with the SC Department of Natural Resources, Columbia, SC.

Alderman, J. 1998. Threat Analysis for the Stevens Creek population of the Carolina Heelsplitter (*Lasmigona* (Platynaias) *decorata* (Lea 1852). Final Report in fulfilment of a Challenge Cost Share Agreement with the Francis Marion and Sumter National Forest, Columbia, SC.

Alderman, J. 2002. *Lasmigona decorata* Monitoring and Habitat Evaluation. Final Report in fulfilment of a Challenge Cost Share Agreement with the Francis Marion and Sumter National Forest, Columbia, SC.

Alexander, D.J-P. 1997. Channel Morphological Adjustment to Soil Erosion and Sedimentation at the Chicken-Strong Creek Confluence, Fairfield County, South Carolina. M.S. Thesis, University of South Carolina, Department of Geography.

Alger, John, 1994. Field investigation and review of historical information within the Chattooga Watershed. Unpublished report.

American Geophysical Union. 1965. Inventory of Representative and Experimental Watershed Studies Conducted in the United States. International Association of Scientific Hydrology and UNESCO. Washington, D.C. 153 pp.

Andrew, J. M. and J. A. Mosher. 1982. Bald Eagle nest site selection and nesting habitat in Maryland. J. Wildl. Management. 46:382-390.

Andrle, R.F. and J.R. Carroll (eds.). 1988. The atlas of breeding birds in New York state. Cornell University Press. 551 pp.

Appalachian Regional Commission. 1970. Annual report. 1666 Connecticut Ave., NW, Washington, DC. 159 pp.

Barber, H. L. 1984. Eastern mixed forest. Pages 345-354. in L. K. Halls, ed. White-tailed Deer: Ecology and Management. Stackpole Books, Harrisburg, Pa.

Barr, T. 1961. Caves of Tennessee. State of Tennessee Department of Conservation and Commerce, Division of Geology. Nashville. Bulletin 64. 567 pp.

Barrett, L, C. Kerr and W. Hansen. 2002. Estimates of Natural Wildfire Frequency Based on Plant Communities and Erosion Calculations for the Sumter National Forest. Unpublished reports and analyses in the process records for Sumter Plan Revision.

Bates, C. G. And A. J. Henry. 1928. Forest and Streamflow Experiments at Wagon Wheel Gap, Colorado. U.S. Weather Bureau Monthly Weather Review No. 30. 70 pp.

Baumann, D.P., Jr., L.D. Vangilder, C.I. Taylor, R. Engle-Wilson, R.O. Kimmel, and G.A. Wunz. 1990. Expenditures for wild turkey hunting. Proc. National Wild Turkey Symp. 6:157-166.

Beringer, J. 1986. Habitat use and response to roads by black bears in Harmon Den, Pisgah National Forest, North Carolina. M.S. Thesis, University of Tennessee, Knoxville. 103 pp.

Bixler, R. and E. Backlund. Chattooga National Wild and Scenic River Trout Angler Substitution Study. Clemson University, Parks Recreation and Tourism Management, Clemson, South Carolina.

Boothe, S. and K. Parker. 2000. American Woodcock. Species-specific management abstracts. Lasting Forests. Dept. of Fish. and Wildlife Science, Virginia Polytechnic Institute and Univ. Available online at: http://fwie.fw.vt.edu/rhgiles/speciesssm/wcock.htm

Borgen, G. (Recreation Program Manager, Andrew Pickens Ranger District, Sumter National Forest) 2002. Personal communications with Joe Robles, Recreation Program Manager, USDA Forest Service, Francis Marion and Sumter National Forests, Columbia, South Carolina.

Bormann, F. H. And G. E. Likens. 1969. The Watershed Ecosystem Concept and Studies in Nutrient Cycles. In: The Ecosystem Concept in Natural Resource Management, G.M. Dyne (ed.). Academic Press. New York. Pp. 49-76.

Brantley, C. G. and S. G. Platt. 2001. Canebrake conservation in the southeastern Unites States. Wildlife Society Bulletin 29(4):1175-1181

Brenneman, R., J. E. Kennamer, and M. Kennamer. 1991. Managing openings for wild turkeys and other wildlife – a planting guide. National Wild Turkey Federation, Edgefield, SC. 39pp.

Brody, A.J. 1984. Habitat use by black bears in relation to forest management in the Pisgah National Forest, North Carolina. Unpublished M.S. Thesis, Univ. of Tenn., Knoxville. 123 pp.

Brody, A.J. and M. R. Pelton. 1989. Effects of roads on black bear movements in western North Carolina. Wild. Soc. Bull. 17:5-10. The Wildlife Society.

Brose, P., D. Van Lear, and R. Cooper. 1999. Using shelterwood harvests and prescribed fire to regenerate oak stands on productive upland sites. For. Ecol. And Manage. 113: 125-141.

Brose, P., T. Schuler, D. Van Lear, and J. Berst. 2001. Bringing Fire Back: The changing regimes of the Appalachian mixed-oak forests. J. For. 99:30-35.

Brown, J.K. 1995. Fire Regimes and Their Relevance to Ecosystem Management. In Proceedings of Society of American Foresters National Convention; 1994 September 18-24; Anchorage, Alaska: pp171-178.

Brown, J.K. 2000 USDA Forest Service General Technical Report. RMRS GTR 42 Vol 2

Brown, R. E. and J. G. Dickson. 1994. Swainson's Warbler (*Limnothlypis swainsonii*). *In* The Birds of North America, No. 126 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural sciences; Washington D. C.: The American Ornithologists' Union.

Brown, T.C. 2000. Economic Issues for Watersheds Supplying Drinking Water. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 4, pages 42-51.

Buckhouse, J.C., 2000. Domestic Grazing. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. pages 153-157.

Buehler, D. A., and C. P. Nicholson. 1999. Ecology of the cerulean warbler in the Cumberland Mountains and Southern Appalachians. 1998 Annual Report. Tennessee Department of Forestry, Wildlife and Fisheries. University of Tennessee.

Buehler, D.A., T.J. Mersmann, J.D. Fraser, J.K.D. Seegar. 1991. Effects of human activity on bald eagle distribution on the northern Chesapeake Bay. J. Wildl. Manage. 55:282-290.

Bulger A., J. Cosby, R. Webb. 1998. Acid Rain: Current and Projected Status of Coldwater Fish Communities in the Southeastern US in the Context of Continued Acid Deposition. A Coldwater Conservation Fund Report. Trout Unlimited, Arlington Virginia. 28 p.

Bulger, A.J., C.A. Dolloff, B.J. Cosby, K.N. Eshleman, J.R. Webb, and J.N. Galloway. 1995. The Shenandoah National Park: Fish in Sensitive Habitats (SNP: FISH) Project: An integrated assessment of fish community responses to stream acidification. Water Air Soil Pollut. 85:309-314.

Bunch, M., J.Sorrow, and A.Dye. 1998. Rafinesque's Big-Eared Bat Surveys and Prelisting Recovery Final Report. U.S.Fish and Wildlife Service and the S.C.Department of Natural Resources, Clemson, SC.

Burkhead, N.M., S.J. Walsh, B.J. Freeman, and J.D. Williams. 1997. Status and restoration of the Etowah River, and imperiled southern Appalachian ecosystem. Pages 375-444 *in* G.W. Benz and D.E. Collins, eds. Aquatic fauna in peril: the southeastern perspective. Special Publ. 1, Southeast Aquatic Research Institute, Lenz Design and Communications, Decatur, GA.

Burns, Richard. 1994. Road Runoff Control. Presented at the Trout Unlimited Southeastern Regional Meeting and Symposium of Siltation and Erosion Control. Dillard, GA. 6pp.

Byrd, M. A., and D. W. Johnston, 1991. Birds. Pages 477-537 in K. Terwilliger, coordinator. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publ. Co., Blacksburg, Virginia.

Campbell, R. W., N. K. Dawe, I. McTaggert-Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall. 1990. The Birds of British Columbia. Volume 1. Nonpasserines: Introduction and loons through waterfowl. University of British Columbia Press, Vancouver, BC, Canada. 514pp.

Carlock, D.M., R.H. Conley, J.M. Collins, P.E. Hale, K.G. Johnson, A.S. Johnson, and M.R. Pelton. 1983. The Tri-State Black Bear Study. The Pope and Young Club and the Tennessee Wildlife Resources Agency. TWRA Tech. Rept. 83-9. 286pp.

Carlock, DM., R. H. Conley, J. M. Collins, P. E. Hale, K. E. Johnson, A. S. Johnson, M. R. Pelton. 1983. The Tri-State Black Bear Study. Tenn. Wild. Resour. Agency.

Carlson, P. 1995. An Assessment of the Old-Growth Forest Resource on National Forest System lands in the Chattooga River Watershed. Chattooga Ecosystem Demonstration Project, Atlanta, GA.

CASTNet, 2002. Clean Air Status and Trends Network . http://www.epa.gov/castnet/

Chameides, W.L.; Cowling, Ellis B.1995. The State of the Southern Oxidant Study (SOS): Policy-relevant findings in ozone pollution research 1988-1994. Southern Oxidant Study. Raleigh, NC: College of Forest Resources, North Carolina State University. 136p.

Christensen, N.L. ????. Variable Fire Regimes on Complex Landscapes: Ecological Consequences, Policy Implications, and Management Strategies.

Clean Air Act, 1990. 42 U.S.C. 7401-7671q

Clingenpeel, A.J. 2002. Sediment Yields and Cumulative Effects for Water Quality and Associated Beneficial Uses. Process Paper for Forest Plan Revisions.

Clingenpeel, A.J., 2003a. Determining Sediment Coefficients for Roads, ATV Trails, and Firelines. Process Paper for SA Forest Plan Revisions, Ouachita National Forest, Hot Springs AR 71902, aclingenpeel@fs.fed.us

Clingenpeel, A.J., 2003b. Sediment Yields and Cumulative Effects for Water Quality and Associated Beneficial Uses. Process Paper for SA Forest Plan Revisions, Ouachita National Forest, Hot Springs AR 71902, aclingenpeel@fs.fed.us

Cohen, J.D. 1999 Reducing the Wildland Fire Threat to Homes: Where and How Much. USDA Forest Service General Technical Report. PSW-GTR-173. pp189-195

Conner, R.C., R.M. Sheffield. 2001. South Carolina's Forest Resources-2000 Update. Resource Bulletin SRS-65, USDA Forest Service, Southern Research Station,.

Cooper, R.J. 2001. Partners in Flight Southern Piedmont Bird Conservation Plan. Draft: September 2001. Daniel B. Warnell School of Forest Resources. University of Georgia, Athens, GA.

Costa, R. and R.E.F. Escano 1989. Red-cockaded woodpecker: status and management in the southern region in 1986. U.S. Dept. of Agric., Forest Service. Tech. Pub. R8-TP 12, Southern Region, Atlanta, GA.

Costa, Ralph. 2001. Red-Cockaded Woodpecker. Pp 309-321. In J.G. Dickson (ed.). 2001. Wildlife of Southern Forests: Habitat and Management. Hancock House Pub. Blaine, WA.

Davis, E., C. McRae, B. Estep, L. Barden, and J. Mathews. 2002. Vascular Flora of Piedmont Prairies: Evidence from Several Prairie Remnants. Castanea 67(1):1-12.

DeGraaf, R. M., V. E. Scott, R, H. Hamre, L. Ernst, and S. H. Anderson. 1991. Forest and Rangeland Birds of the United States. Natural History and Habitat Use. U.S.D.A. Forest Service. Agricultural Handbook 688. 625pp.

Del Hoyo, J., A. Elliot, and J. Sargatal. 1996. Handbook of the birds of the world. Volume 3. Lynx Editions. Barcelona. 821 pp.

Delcourt, H.R. 1987. The impact of prehistoric agriculture and land occupation on natural vegetation. Trends in Ecology and Evolution 2:39-44

Delcourt, P.A., H.R. Delcourt. 1998. The influence of prehistoric human-set fires on oak-chestnut forests in the southern Appalachians. Castanea 63:337-345

DeSelm, H. and N. Murdock. 1993. Grass-dominated Communities. IN: Biodiversity of the Southeastern United States – Upland Terrestrial Communities. Eds.W. Martin, S. Boyce, and A. Echternacht. John Wiley & Sons, Inc.

Dessecker, D.R., D.G. McAuley. 2001. Importance of early successional habitat to ruffed grouse and American woodcock. Wildlife Society Bulletin 29(2):456-465

Dibble A.C., W. A. Wright and C. S. Campbell. 1997. Small Whorled Pogonia (Isotria medeoloides): Demographic Monitoring and Habitat Manipulation Experiment. Unpubl. Report prepared for the Maine Natural Areas Program, Maine Dept. of Conservation. 8pp.

Dickson, J.G. 2001. Wildlife of Southern Forests: Habitat and Management. Hancock House Publishers, Ltd. Surrey, B.C. and Blaine, WA.

Dimmick, R. W., J. D. Sole, W. G. Minser, and P. E. Hale. 1996. Response of ruffed grouse to forest management in the Southern Appalachian Mountains. Proc. 7th International Grouse Symp. Fort Collins, CO.

Dimmick, R. W., M. J. Gudlin, and D. F. McKenzie. Coordinators/Editors. 2001. The Northern Bobwhite Conservation Initiative. A report on the status of the northern bobwhite and a plan for recovery of the species. Southeast Quail Study Group Tech Comm. Report to Sate Wildlife Agency Directors of the Southeastern Assoc. of Fish and Wildl. Agencies. Draft.

Dimmick, R.W., M.J. Guldin, and D.F. Mckenzie. 2002. The Northern Bobwhite Conservation Initiative. Miscellaneous publication of the Southeastern Association of Fish and Wildlife Agencies, South Carolina. 96 pp.

Dissmeyer, G. E.; Foster, G. R. 1984. A Guide for Predicting Sheet and Rill Erosion on Forest Land. USDA-Forest Service, Southern Region. Technical Publication R8-TP6. 40 pages.

Dissmeyer, G. E.; Stump, R. F. 1978. Predicted Erosion Rates for Forest Management Activities in the Southeast. U. S. Department of Agriculture. Forest Service. State and Private Forestry, Southeastern Area. Atlanta GA. 39 pages.

Douglas, J.E. and D.H. Van Lear. 1982. Prescribed burning and water quality of ephemeral streams in the piedmont of South Carolina. Forest Science 29: 181-189.

Downs A. and W. McQuilkin. 1944. Seed production of southern Appalachian oaks. J. Forestry 42:913-920.

Droge, D., J. PLissner, S. Gauthreaux, Jr., and W. Jarvis. 1993. Clear-cut--longleaf pine regeneration. J. Field Ornith. 64:111 (supplement).

Dunford, R.D. and R.B. Owen, Jr. 1973. Summer behavior of immature radio-equipped woodcock in central Maine. Journal of Wildlife Management 37: 462-469.

Durniak, J.P. 1989. A fisheries survey of the upper Chattooga River. Georgia Department of Natural Resources, Game and Fish Division, Atlanta, Georgia.

Durniak, J.P., and W.R. Ruddell, 1990. Evaluation of trout fingerling stocking in small headwater trout streams. Georgia Department of Natural Resources, Game and Fish Division, Atlanta, GA. 52 pp.

Dwyer, T.J., E.L. Derleth and D.G. McAuley. 1982a. Woodcock brood ecology in Maine. U.S. Fish and Wildlife Service. Research Reports 14: 63-70.

Eiler, J. 1981. Reproductive biology of black bears in the Smoky Mountains of Tennessee. M.S. Thesis, University of Tennessee, Knoxville. 83 pp.

Eiler, J., G.Wathen and M. Pelton. 1989. Reproduction in black bears in the southern Appalachian Mountians. J. Wildl. Manage. 53:353-360.

Ellis, Jack A.; Edwards, William R.; Thomas, Keith P. 1969. Responses of bobwhites to management in Illinois. Journal of Wildlife Management. 33(4): 749-762. [16070]

English, William R. 1990. An Assessment of Water Quality in the Chattooga River and Tributaries Through Analysis of the Benthic Macroinvertebrate Community Structure. Unpublished report.

EPA, 2001. Total Maximum Daily Load (TMDL) for Sediment in the Chattooga River Watershed for Listed Segments. Region 4, Environmental Protection Agency, Atlanta, GA, 53 pp.

Ernst, J.P. and V. Brown. 1988. Conserving Endangered Species on Southern Forested Wetlands. In Proceedings of the symposium The Forested Wetlands of the Southern United States. Ed. D.D. Hook and R. Lea. Orlando, FL. General Tech. Rep. SE-50, Asheville , NC: U.S. Department of Agriculture, Forest Service, Southern Forest Experimental Station. 168pp.

Escano, Ronald E.F. 1995. Red-cockaded Woodpecker Extinction or Recovery: Summary of Status and Management on Our National Forests. Pp. 28-35. *In* D.L. Kulhavy, R.G. Hooper, and R. Costa (eds.). 1995. Red-cockaded Woodpecker: Recovery, Ecology and Management, Proceedings of the Third Red-cockaded Woodpecker Symposium. Center for Applied Studies in Forestry, Stephen F. Austin State University. Nacogdoches, TX. 507 p.

Etnier, D.A. 1997. Jeopardized southeastern freshwater fishes: a search for causes. Pages 88-104 *in* G.W. Benz and D.E. Collins, eds. Aquatic fauna in peril: the southeastern perspective. Special Publ. 1, Southeast Aquatic Research Institute, Lenz Design and Communications, Decatur, GA.

Etnier, D.A. and W.C. Starnes. 1993. The fishes of Tennessee. University of Tennessee Press, Knoxville, TN.

Executive Order 11988, FSM 2527

Federal Register. 1976. Chattooga Wild and Scenic River – Classification, Boundaries, and Development Plan. Volume 41, Number 56, Washington, D.C.

Feldhammer, G. A., T. P. Kilbane, and D. W. Sharp. 1989. Cumulative effect of winter on acorn yield and deer body weight. J. Wildl. Manage. 53:292-295.

Feltman, A., D.L. Law, and W.F. Hansen, 1996. Emergency Watershed Protection Soil Bioengineering Project at Woods Ferry Recreational Area. USDA Forest Service Report. Columbia, SC. 12 pp.

FLAG, 2000. Federal Land Managers' Air Quality Related Values Workgroup, Phase I Report. U.S. Forest Service-Air Quality Program, National Park Service-Air Resources Division, and U.S. Fish and Wildlife Service-Air Quality Branch.

Fletcher, B. 1999. Personal communication. Review of draft report by Georgia DNR.

Ford, W. M., A. S. Johnson, P. E. Hale, and J. M. Wentworth. 1993. Availability and use of spring and summer woody browse by deer in clearcut and uncut forests of the Southern Appalachians. South. J. Appl. For. 17:116-119.

Foss, C.R. (editor). 1994. Atlas of breeding birds in New Hampshire. Arcadia Press. 414 pp.

Fowells, H. 1965. Silvics of forest trees of the United States. Agriculture Handbook No. 271. USDA Forest Service, Washington, DC. 762 pp.

Franklin, Jerry F. 1988. Structural and Functional Diversity in Temperate Forests. Pp. 166-175, in Biodiversity, E. O. Wilson editor, National Academy Press

Frost, C. 2002. Presettlement vegetation groupings for the Sumter National Forest (very preliminary approximation). Unpublished draft. Plant Ecologist, Plant Conservation Program, Raleigh, NC.

FSM 2527.05, Floodplain Management and Wetland Protection; and Executive Order 11988, Floodplain Management

GA, 2000. Georgia's 2000 303(d) Waters. Georgia Department of Natural Resources, Environmental Protection Division.

Gaddy, C. 1991. The Status of *Echinacea laevigata* (Boynton & Beadle) Blake. U.S. Fish and Wildlife Service and NC Deaprtment of Environment, Health, and Natural Resources. Raleigh, NC.

Gaddy, C. 1998. Old-Growth and Potential Old-Growth Forests of the Chauga River Basin, Andrew Pickens District, Sumter National Forest, Oconee County, South Carolina. Prepared for Forest Watch, Westminster, SC.

Gaddy, L. 1985. The Status of *Isotria medeoloides* in South Carolina. Prepared for the SC Wildlife and Marine Resources Department, Columbia, SC.

Gaddy, L. 1992. An Inventory of Endangered, Threatened, and Otherwise Noteworthy Plant Species and Natural and Unique Areas of the Andrew Pickens District of the Sumter National Forest. Prepared for the Sumter NF, the SC Heritage Trust, and the SC Nature Conservancy. Columbia, SC.

Gaines, G. and E. Morris. 1996. The Southern National Forest's Migratory and Resident Landbird Conservation Strategy. USDA Forest Service, Atlanta, GA. 120 pp.

Garner, M. S. 2001. Movement patterns and behavior at winter feeding and fall baiting stations in a population of white-tailed deer infected with bovine tuberculosis in the northeastern lower peninsula of Michigan. Ph.D. Thesis. Michigan State University, East Lansing. 269pp.

Geddings, W.R. and D.M. Rankin. 1999. Fisheries investigations in lakes and streams. District 1 Annual Progress Report, South Carolina Department of Natural Resources, Columbia, South Carolina.

Glasser, S.P. 2000. Hydromodifications – Dams, Diversions, Return Flows, and other Alterations of Natural Water Flows. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 5, pages 55-61.

Gobster, P.H. 2001. Human dimensions of early successional landscapes in the eastern United States. Wildlife Society Bulletin 29(2):474-482

Goddard, Art, 1982. Soil Loss and Sediment Yield Rates for Land Management Planning for the Sumter National Forest. Sumter National Forest Plan 1985 Process Records.

Green, N. 1985. The Bald Eagle. Pp. 508-531 in R.L. DiSilvestro, ed., Audubon Wildlife Report 1985. National Audubon Society, New York.

Greenberg, C. 1999. Summary: Acorn production by southern Appalachian oaks, 1993 - 1997. Unpublished report. USDA Forest Service, Bent Creek Experimental Forest, Asheville, NC.

Grossman, D.H., D. Faber- L. Sneddon. 1998. International Classification Of Ecological Communities: Terrestrial Vegetation Of The United States. Volume I. The National Vegetation Classification System: Development, Status, And Applications. The Nature Conservancy, Arlington, Virginia, USA.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley Langendoen, A.S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia, USA.

Guimaraes, W.B. and L. R. Bohman, 1992. Techniques for Estimating the Magnitude and Frequency of Floods in South Carolina, 1988. USGS Water-Resources Investigations Report 91-4157. 174 pages.

Hale, P. E., A. S. Johnson, and J. L. Landers. 1982. Characteristics of ruffed grouse drumming sites in Georgia. J. Wildl. Manage. 46:115-123.

Hamel, Paul B. 1992. Land Manager's Guide to the Birds of the South. The Nature Conservancy, Southeastern Region, Chapel Hill, NC, 437 pp.

Haney, J. C. 1996. Status/trend of the ruffed grouse in the Southern Appalachians. Fact Sheet. The Wilderness Society. Washington, D. C. 1pp.

Hansen, 1991. Land Rehabilitation on the Sumter National Forest, Proceedings of the Fifth Interagency Sedimentation Conference, Las Vegas, Nevada, pp. 3-110-117.

Hansen, W. F. and D. L. Law. 1993. Riparian Management on the National Forests in South Carolina. In Riparian Ecosystems in the Humid U.S. Conference Proceedings, Atlanta, GA. National Association of Conservation Districts, Washington, DC. pp. 56-64.

Hansen, W. F. and D. L. Law. 1996. Watershed Restoration after Calamity. In Symposium Proceedings on Watershed Restoration Management, Syracuse, New York. Am. Water Resources Assoc. Tech. Pub. Series TPS-96-1, Herndon, VA. pp. 187-198.

Hansen, W.F. 1998. Chattooga River Watershed Assessment – Water Quality, Stream Information and Conditions. Report for USDA Forest Service and Environmental Protection Agency. 34 pages.

Hansen, W.F. 1998. Chattooga River watershed: water resource inventory and stream and drainage characteristics. USDA Forest Service, Francis Marion and Sumter National Forests, Columbia, South Carolina.

Hansen, W.F. 2001. Identifying Stream Types and Management Implications. Forestry Ecology and Management. Elsevier Science, Ltd. Volume 143/Issue 1-3. pages 39-46.

Hansen, W.F. and D.L. Law, 1996. Watershed Restoration After Calamity. In Proceedings on Watershed Restoration Management. J.J. McDonnell, J.B. Stribling, L.R.Neville and D.J.Leopold (Editors). AWRA Symposium, Syracuse, New York, pp. 187-198.

Hansen, W.F. and D.L. Law. 2000. Sediment from a Small Ephemeral Gully in South Carolina. In Proceedings of South Carolina Water and Environment Symposium, November 2000.

Hansen, W.F., 1987. Some Applications of Flood Frequency and Risk Info. in Forest Mgmt., In Application of Frequency and Risk in Water Resources, Dr. V.P. Singh (Ed.), D. Reidel Pub. Co., pp. 219-226.

Hansen, W.F., 1991. Land Rehabilitation on the Sumter National Forest, In Proceedings of the Fifth Federal Interagency Sedimentation Conference, Drs. S. Fan and Y. Kuo (Editors), Las Vegas, Nevada. Volume 1, pp. 3-110 to 3-117.

Hansen, W.F., 1995. Gully Treatments. In Proceedings of Watershed Assessment and Restoration Workshop, National Advanced Resource Technology Center, USDA Forest Service, Marana, Arizona. 17pp.

Hansen, W.F., 1998. Chattooga River Ecosystem Demonstration, Sream Temperature Survey.

Hansen, W.F., 2001. Identifying stream types and management implications. Forest Ecology and Mangement, Volume 143, pages 39-46.

Hansen, W.F., Chattooga River Watershed – Water Resource Inventory, Stream and Drainage Characteristics. 1998. Report for USDA Forest Service and Environmental Protection Agency. 45 pages plus several hundred pages within appendices.

Hansen, W.F., D. Rightmeyer, J. Kidd, and M. W.F. Seehorn. 1991. Reed Creek Watershed and Fisheries Improvement Project. In Proceedings of the 1991 Georgia Water Resources Conference. Athens, GA. Pages 241-244.

Hansen, W.F., D.L. Law and D.V. Rosdahl. 1989. Implementation Monitoring of Soil and Water Resources in South Carolina. In Proceedings of the USDA-FS National Soil and Water Monitoring Workshop. Sacramento, CA. 7 pp.

Hansen, W.F., J. Henderson and D. L. Law, 1994. Erosion and Sediment Yield Background Information Using Sumter National Forest Plan Process Records. Sumter National Forest Records.

Hansen, W.F., J.D. Henderson and D.L. Law. 1994. Erosion and Sediment Yield Background Information Using Sumter National Forest Process Records. Unpublished.

Hansen, W.F., L. Huffakre, and G. Dissmeyer. 1990. Proceedures Used for Determining Water Rights on the Caribbean National Forest. In Proceedings of Watershed Planning and Analysis in Action Symposium, Durango, Colorado, pp. 360-369.

Hansen, W.F., R. Osborne, and J. Wise, 1998. Stekoa Creek Fecal Coliform Impairs Chattooga River Water Quality. Cooperative work between Stekoa Creek Water Quality Committee, Clemson University and USDA Forest Service.

Hansen, W.F., T. Koman, J. Knibbs, and A. Wolfe, A., 2003. Draft Indian Creek Hydrologic Condition Analysis, Enoree Ranger District, Sumter National Forest, Columbia, SC

Hansen, William F., 1991. Land Rehabilitation on the Sumter National Forest, In Proceedings of the Fifth Federal Interagency Sediment. Conf., Drs. S. Fan and Y. Kuo (Editors), V1, pp. 3-110 to 3-117.

Hansen, William F., Dick Rightmeyer, Jim Kidd, and Monte Seehorn. 1991. Reed Creek Watershed and Fisheries Improvement Project. In Proceedings of the 1991 Georgia Water Resources Conference. Athens, GA. Pages 241-244.

Hansen, William F.,1993. Environmental Assessment, Highway 76 Waste Treatment Facility. Unpublished estimated effect of Stekoa Creek suspended sediment and fecal coliform loads on the Chattooga River water quality based on USGS data.

Hansen, William, 1998. Chattooga River Ecosystem Demonstration Project, Summary of Water Quality Team Operations. Provides an overview of team activities and the different projects and activities that were undertaken or contributed to during the life of project (1993-1995). Published abstract in 1995 SAMAB Conference. Unpublished report.

Hansen, William, 1998. Chattooga River Ecosystem Demonstration, Sream Temperature Survey. Unpublished report.

Hansen, William, 1998. Chattooga River Watershed Water Resource Inventory. Unpublished report of instream and drainage analyses for numerous stations measured across the Chattooga watershed.

Hansen, William, Dick Rightmyer, Jim Kidd and Monte Seehorn, 1991. Reed Creek Watershed and Fishery Improvement Project, In Proceedings of the 1991 GA Water Resources Conf., K.J. Hatcher (Ed.), pp. 241-244.

Hansen, William, Robert Osborne, and Jack Wise, 1998. Stekoa Creek Fecal Coliform Impairs Chattooga River Water Quality. Cooperative work between Stekoa Creek Action Committee, Clemson University and US Forest Service. Unpublished report.

Happ, S.C. 1945. Sedimentation in South Carolina Piedmont Valleys. American Journal of Science, Volume 243, No. 3. pp. 113-126.

Harlow, R. F., and R. G. Hooper. 1971. Forages eaten by deer in the Southeast. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 25:18-46.

Harlow, R. F., J. B. Whelan, H. S. Crawford, and J. E. Skeen. 1975. Deer foods during years of oak mast abundance and scarcity. J. Wildl. Manage. 39:330-336.

Harris D. U. S. Fish and Wildlife Service. Sept. 1998. Personal communication.

Harris, L.D. 1988. The nature of cumulative impacts on biotic diversity of wetland vertebrates. Environ. Manage. 12(5):675-693.

Harris, Larry D. 1984. The Fragmented Forest: Island biogeography theory and the preservation of biotic diversity. The University of Chicago Press 211 pp.Foster, D.R., and E.R. Boose. 1992. Patterns of forest damage resulting from catastrophic wind in central New England, USA. Journal of Ecology 80:79-98

Harris, M. J. 1981. Spring and summer ecology of ruffed grouse in northern Georgia. M. S. Thesis. Univ. Georgia, Athens. 133pp.

Hatcher, Robert D. Jr. and others. 1968-1976+ Geological maps by USGS Quadrangle showing both field and office interpretations of both visible and expected geological materials, fault and shear zones and underlying stratigraphy. National Science Foundation.

Healy, W. M., and E. S. Nenno. 1983. Minimum maintenence versus intensive management of clearings for wild turkeys. Wildl. Soc. Bull. 11:113-120.

Heede, B.H., 1982. Gully Control: Determining Treatment Priorities for Gullies in a Network. Environmental Management, Volume 6, Number 5. Published by Springer-Vertag New York Inc. pp. 441-451.

Heede, B.H.,1976. Gully Development and Control - The Status of Our Knowledge. USDA Forest Service Research Paper RM-169. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 42 pp.

Hem, J. D. 1970. Studies and Interpretation of Chemical Characteristics of Natural Water. U.S. Water Supply Paper 1473. 363 pp.

Henderson, K., K. Brock, R. Ellis, D. Rightmyer and W. Hansen 1991. Water Management on the Chattahoochee-Oconee National Forests. In the Georgia Water Resources Conference Proceedings, Athens, Georgia

Hershfield, D.M., 1962. Rainfall Frequency of the United States, Technical Paper 40. US Dept. of Commerce, Weather Bureau, Washington, DC. Reprinted in 1963, 61 pages.

Hewlett, J. D. and A.R. Hibbart. 1965. Factors Affecting the Response of Small Watersheds to Precipitation in Humid Areas. In International Symposium on Forest Hydrology. W.E. Sopper and H.W. Lull (eds.). Pergamon Press, NY. pp. 275-290.

Hewlett, J.D. and L. Pienaar. 1973. Design and Analysis of the Catchment Experiment. In: Proceedings - Symposium on the Use of Small Watersheds in Determining Effects of Forest Land Use on Water Quality. E.H. White (ed.). University of Kentucky, Lexington. pp. 88-106.

Hewlett, J.D., H.W. Lull and K.G. Reinhart. 1969. In Defense of Experimental Watersheds. Water Resources Research. Volume 5:306-316.

Hibbart, A.R. 1965. Forest Treatment Effects on Water Yield. In: International Symposium on Forest Hydrology. W.E. Sopper and H.W. Lull (eds.). Pergamon Press. New York. pp. 527-543.

Hicks, M. L. 1992. Guide to the Liverworts of North Carolina. Duke University Press, Durham, NC.

Hillel, D. 1971. Soil and Water Physical Principles and Processes. Academic Press. New York. 498 pp.

Hogsett, W. E.; Plocher M; Wildman V.; Tingey, D. T. and Benett, J. P. 1985. Growth response of two varieties of slash pine seedlings to chronic ozone exposures. Can. J. Botany 63:2369-2376.

Holcomb, J. et. al., 1999. Watershed Analysis – A Proposed Process for Forest Planning. US Forest Service, Southern Region.

Hook, D.D., W. McKee, T. Williams, B. Baker, L. Lundquist, R. Martin, and J. Mills. 1991. A Survey of Voluntary Compliance of Forestry Best Management Practices. South Carolina Forestry Commission. Columbia, South Carolina. 23 p.

Hoover, M.D., 1949. Hydrological Characteristics of South Carolina Piedmont Forest Soils. Proceedings of the Soil Science Society. pp 353-358.

Hopey, Mark (1992) A Preliminary Assessment of Water Quality in Stekoa Creek Using a Fish Based Index of Biotic Integrity. Unpublished Report, UNC-Ashville, Department of Environmental Studies, 27 pp.

Horton, G.I. and M.C. Causey. 1979. Woodcock movements and habitat utilization in central Alabama. Journal of Wildlife Management 43:414-420

Howard, R.J. and J.L. Allen. 1988. Streamside Habitats in Southern Forested Wetlands: Their Role and Implications for Management. In Proceedings of the Symposium The Forested Wetlands of the Southern United States. Ed. D.D. Hook and R. Lea. Orlando, FL. General Tech. Rep. SE-50, Asheville , NC: U.S. Department of Agriculture, Forest Service, Southern Forest Experimental Station. 168pp.

Hunter, C., R. Katz, D. Pashley, and R. Ford. 1999. Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Physiographic Area 23). Version 1.0. December 1999. U.S. Fish and Wildlife Service, Social Circle, Georgia. 85 pp.

Hunter, M.L., Jr. 1990. Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity. Prentice Hall, Englewood Cliffs, New Jersey. 370 pp.

Hunter, W. C., D. A. Buehler, R. A. Canterbury, J. L. Confer, and P. B. Hamel. 2001. Conservation of Disturbance-Dependent Birds in Eastern North America. Wildlife Society Bulletin 29: 440-455.

Hurst, G. A. 1978. Effects of controlled burning on wild turkey poult food habits. Proc. Ann. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 32:30–37.

Hurst, G. A. and J. G. Dickson. 1992. Eastern turkey in southern pine-oak forests. Pages 265-285. in J. G. Dickson, ed. The Wild Turkey: Biology and Management. Stackpole Books, Harrisburg, PA.

Ilhardt et al. 2000

Illhardt, B.L. et. al., "Defining riparian areas", pp. 23-42, in E.S. Verry, J.W. Hornbeck, and C.A.Dolloff (editors), "Riparian Management in Forests in the Continental Eastern United States", Lewis Publishers, New York, 2000, 402 pp.

IMPROVE, 2000. Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States, Report III. ISSN: 0730-5352-47. Ft. Collins, Colorado: Cooperative Institute for Research in the Atmosphere.

IMPROVE, 2001. Interagency Monitoring of Protected Visual Environments website. http://vista.cira.colostate.edu/improve/

IMPROVE, 2002. Interagency Monitoring of Protected Visual Environments website. http://vista.cira.colostate.edu/improve/

Irby, C., S. Gauthreaux, Jr., and W. Jarvis. 1995. Clear-cut--longleaf pine regeneration. J. Field Ornith. 66:116 (supplement).

Irby, C., S. Gauthreaux, Jr., and W. Jarvis. 1996. Clear-cut--longleaf pine regeneration. J. Field Ornith. 67:89-90 (supplement).

Johnson, A. S., P. E. Hale, W. M. Ford, J. M. Wentworth, and O. F. Anderson. 1995. White-tailed deer foraging in relation to successional stage, type, and management of Southern Appalachian Forests. Am. Midl. Nat. 133:18-35.

Johnson, P. 1994. How to manage oak forests for acorn production. USDA Forest Service, North Central Forest Experiment Station Technical Brief TB-NC-1. Columbia, MO.

Jones, D., 2000. Implementation Monitoring of Forestry Best Management Practices for Harvesting and Site Preparation in South Carolina 1997-1999. South Carolina Forestry Commission. Columbia, South Carolina.

Jones, S. 1988. Old-Growth Forests within the Piedmont of South Carolina. Natural Areas Journal 31 (8): 31-37.

Jonkel, C.J.. 1978. Black, Brown (Grizzly), and Polar Bears. Pgs. 227-248 In: Big Game of North America, Ecology and Management. The Wildlife Management Inst., Wash., DC. 494pp.

Kammermeyer, K. 1999. Personal communication. Review of draft report by Georgia Department of Natural Resources.

Kammermeyer, K. E., and E. B. Moser. 1990. The effects of food plots, roads, and other variables on deer harvest in northeast Georgia. Proc. Annu Conf. Southeast. Assoc. Fish and Wildl. Agencies 44:364-373.

Kammermeyer, K. E., W. M. Lentz, E. A. Padgett, and R. L. Marchinton. 1993. Comparision of three ladino clovers used for food plots in northeast Georgia. Proc. Annu Conf. Southeast. Assoc. Fish and Wildl. Agencies 47:44-52.

Kammermeyer, K.E., and R. Thackston. 1995 Habitat Management and supplemental Feeding. Pages 129-154 in K.V. Miller and R.L. Marchinton, ed. Quality Whitetails: The why and how of quality deer management. Stackpole Books. Mechanicsburg, PA.

Kastning, E. and Kastning, K. 1990. Sinkhole Management. Reprint from Jordan, J. and Walsh, J. Proceedings of the National Cave Management Symposium, 3-7 October 1989, New Braunfels, TX. 12 pp.

Keck, R. and J. Langston. 1992. The wild turkey's value and future. Pages 388-415 *in* J.G. Dickson, ed., The wild turkey biology and management. Stackpole Books. Harrisburg, PA.

Keppie, D.M. and R.M. Whiting, Jr. 1994. American Woodcock (SCOLOPAX MINOR). IN A. Poole and F. Gill (eds.), The Birds of North America, No. 100. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, DC. 28 pp.

Kilgo, John C., Karl V. Miller, Winston P. Smith. 1999. Effects of Group-Selection Timber Harvest in Bottomland Hardwoods on Fall Migrant Birds. J. Field Ornithology, 70(3):404-413

Kinney, T.D. 1997. Class V Whitewater Paddlers in American Culture: Linking Anthropology, Recreation Specialization, and Tourism to Examine Play. Northern Arizona University, Flagstaff, Arizona.

Kinscher, K., Plant Ecologist and *Echinacea laevigata* expert. University of Kansas. Personal communication on September 27, 2002 with Robin Roecker.

Kirkpatrick, R. L. 1989. Value of acorns for ruffed grouse and wild turkeys. Pages 15-17 in C. E. McGee, ed. Proceedings workshop Southern Appalachian mast Management. USDA For. Serv. and Univ. Tennessee.

Klimstra, W. D.; Roseberry, John L. 1975. Nesting ecology of the bobwhite in southern Illinois. Wildlife Monographs No. 41. Washington, DC: The Wildlife Society. 37 p. [16189]

Knutson, K. L. and Naef, V.L. 1997. Management recommendations for Washington's priority habitats: riparian. Washington Department Fish and Wildlife, Olympia, WA. 181pp.

Kodama, H.e. and D.H. Van Lear. 1980. Prescribed burning and nutrient cycling relationships in young loblolly stands. Southern Journal of Applied Forestry 4: 118-121.

Kral, R. 1983. A report on some rare, threatened, or endangered forest-related vascular plants of the south. Vol. I. Isoetaceae through Euphorbiaceae. USDA Forest Service Southern Region. Atlanta, Georgia. Tech. publ. R8-TP 2. Page 214-217.

Krementz, D.G., and G.W. Pendleton. 1994. Diurnal habitat use of American Woodcock wintering along the Atlantic coast. Canadian Journal of Zoology 72: 1945-1950.

Krementz, D.G., and J.J. Jackson. 1999. Woodcock in the Southeast: natural history and management for landowners. The University of Georgia College of Agriculture and Environmental Science/ Cooperative Extension Service. U.S. Fish and Wildlife Service. Available online at: http://www.ces.uga.edu/pubcd/b1183.htm.

Kubisiak, J. F. 1985. Ruffed grouse habitat relationships in aspen and oak forests of central Wisconsin. Wisconsin Dept. Nat. Resour. Tech Bull. 151. 22pp.

Kubisiak, J. F. 1989. The best year-round cover. Pages 320-321. in S. Atwater and J. Schnell, eds. Ruffed Grouse. Stackpole Books, Harrisburg, PA.

Kuzejeski, E. W., B. W. Hunyadi, and D. A. Hamilton. 1987. The ruffed grouse in Missouri: restoration and habitat management. Missouri Dept. Conserv. Terrestrial Series # 17. 14pp.

Lancia, Richard A., John A. Gerwin, Michael S. Mitchell, Wiliam M. Baughman, T. Bently Wigley. 2000. Avian diversity and productivity on an intensively managed, industrial forest in South Carolina: The Westvaco example. In Fragmentation 2000 Conference, September 17-20, 2000, Annapolis, Maryland.

Landsberg, J.D. and A.R. Tiedmann, 2000. Fire Management. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 12, pages 124-138.

Lassettre, N.S. and R.R. Harris. 2001. The geomorphic and ecological influence of large woody debris in streams and rivers. University of CA, Berkeley. 68pp.

Laverty, L. and Williams, J. 2002. National Fire Plan. Managing the Impacts of Wildfires on Communities and the Environment. Protecting Prople and Sustaining Resources in Fire-Adapted Ecosystems. A Cohesive Strategy. USDA Forest Service Management Response to the General Accounting Office Report GAO/RCED-99-65 October 13, 2000.

Law, D.L., W.F. Hansen, D.D. Truss, J.N. Shannon, Jr., and D.K. Barnes. 2000. Proceedings of Ecosystem Restoration on the Sumter National Forest in the Piedmont of South Carolina. In Piedmont Ecology and Conservation Symposium 2000. November 2000.

Lefohn, A. S., 1998. The identification of ozone exposures that result in vegetation visible injury and growth loss for specific species in the Southern Appalachian Mountain region. Report on file at: Southern Appalachian Mountain Intitiative, 59 Woodfin Place, Asheville, NC 28801.

Lefohn, A. S.;Runeckles, V. C. 1987. Establishing a standard to protect vegetation - ozone exposure/dose considerations. Atmos. Environ. 21:561-568.

Leftwich, Kevin and Martin Underwood, March, 1996. West Fork Chattooga River Watershed Survey - Habitat and Fish Summary for Spring 1993. Southern Research Station, Coldwater Fisheries Research Unit and Center for Aquatic Technology Transfer, C.Andrew Dolloff, Unit Leader, Dept of Fisheries and Wildlife, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061-0321.

Litvaitis, J.A. 2001. Importance of early-successional habitats to mammals in eastern forests. Wildlife Society Bulletin 29: 466-473.

Loeb, S.C., W.D. Pepper, and A.T. Doyle. 1992. Habitat characteristics of active and abandoned red-cockaded woodpecker colonies. South. J. Appl. For. 16:120-125.

Loftis, D. L. 1990. A shelterwood method for regenerating red oak in the Southern Appalachians. For. Sci. 36:917-929.

Loftis, D. L. 1991. A shelterwood method for regenerating red oak in the Southern Appalachians. For. Sci. 36:917-929.

Long, K. 1988. American forester. Philadelphia: Running Press. 192pp.

Lorimer, C.G. 2001. Historical and ecological roles of disturbance in eastern North American forests: 9,000 years of change. Wildlife Society Bulletin 29(2):425-439

Lynch, James A.; Grimm, Jeffrey W.; Corbett, Edward S. 1997. Enhancement of regional wet deposition estimate based on modeled precipitation inputs. University Park PA: The Pennsylvania State University, School of Forest Resources.

Malm, William C. 1999. Introduction to Visibility. Cooperative Institute for Research in the Atmosphere (CIRA), Ft. Collins, CO. 68 pp.

Martin, A. C., H. S. Zim, and A. L. Martin. 1951. American Wildlife and Plants : A guide to wildlife food habits. McGraw-Hill Book Co., Inc. New York. 500pp.

Mass, Richard P. (1993) A Preliminary Assessment of Pollutant Sources in the Stekoa Creek, Georgia Watershed. Environmental Quality Institute Technical Report #93-012.

Mathews, J. 1993. Status Survey of *Aster georgianus* Alexander. NC Plant Conservation Program.

McAuley, D.G., J.R. Longcore, G.F. Sepik, and G. W. Pendleton. 1996. Habitat characteristics of American Woodcock nest sites on a managed area in Maine. Journal of Wildlife Management 60:138-148

McCabe, R.E., and T.R. McCabe. 1984. Pages 19-72 in L.K. Halls, ed. White-tailed deer ecology and management. Wildl. Manage. Inst. Stackpole Books. Harrisburg, PA.

McKee, W.H. and D.L.Law, 1985. Response to Fertilization on the Francis Marion and Sumter National Forests. Progress and Final Report No. FS-SE-1103-157(2). Southern Experiment Station, Charleston, SC. 16 pp.

McKee, W.H., D.L. Gartner and D.L. Law, 1995. Pilot Scale Fertilization of Pole-Sized Stands of Loblolly Pine on the Sumter National Forest. Final Report No. FS-SE-4102-188(2). Center for Forested Wetlands Research, Southern Research Station, Charleston, South Carolina. 13 pp.

McLaughlin, K., J. Ragus and W.F. Hansen. 2002. Soil and Water Conservation Practices Guide. USDA Forest Service-Region 8. Atlanta, GA. 149 pages.

McLaughlin, K., R. LaFayette and R. Burns., 1981. Procedures for Preparing Soil Loss, Sediment Yield and Water Yield Estimates for Forest Plans. Region 8 Planning Guidance, 1985 Sumter National Forest Plan Process Records.

Mendall, H.L. and C.M. Aldous. 1943. The ecology and management of the American Woodcock. Maine Cooperative Wildlife Research Unit. 201pp.

Meyer, J.L., L.A. Kaplan, D. Newbold, D.L. Strayer, C.J. Woltemade, J.B. Zedler, R. Beilfuss, Q. Carpenter, R. Semlitsch, M.C. Watzin, and P.H. Zedler, 2003. Where Rivers are Born: The Scientific Imperative for Defending Small Streams and Wetlands. Sponsored and Published by American Rivers and Sierra Club. 23 Pages.

Miller, K.V. 2001. White-tailed Deer. Pages 96-106 in J. G. Dickson, ed Wildlife of Southern Forests. Hancock House Publishers, Blaine, WA.

Miller, R. 1974. The Geologic History of Tennessee. State of Tennessee Department of Conservation, Division of Geology. Nashville. Bulletin 74. 63 pp.

Miller, R.R., J.D. Williams, and J.E. Miller. Extinctions of North American fishes during the past century. Fisheries 14(6):22-38.

Milstead, W. 1978. Status report on *Ribes echinellum*. US Fish and Wildlife Service, Atlanta, GA. 19 p.

Morgenweck, R.O. 1977. Diurnal high use areas of hatching-year female American Woodcock. Pp. 155-160 in Proc. Sixth Woodcock Symposium. (D.M. Deppie and R.B. Owen, Jr., editors). New Brunswick Department of Natural Resources, Fredericton.

Murray, Robert W.; Frye, O. E., Jr. 1957. The bobwhite quail and its management in Florida. Tallahassee, FL: Florida Game and Freshwater Fish Commission. 56 p. [16198]

Mussleman, R. C.; Huerta, A. J.; McCool, P. M.; and Oshima, R. J. 1986. Response of beans to simulated ambient and uniform ozone distribution with equal peak concentrations. J. Am. Soc. Hort. Sci. 111:470-473.

Mussleman, R. C.; Oshima, R. J. and Gallavan, R. E. 1983. Significance of pollutant concentration distribution in the response of 'red kidney' beans to ozone. J. Am. Soc. Hort. Sci. 108:347-351.

Nadareski, C.A. 2000. Water Birds. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 16, pages 164-168.

NAPAP. 1991. Acidic Deposition: State of Science and Technology. Summary Report of the U.S. National Acid Precipitation Assessment Program. National Acid Precipitation Assessment Program. Washington, DC. 265 pp.

National Forest Management Act. 1976. 36 C.F.R. 219.1(b)(3).

National Reasearch Council, 2002. Riparian Areas: Functions and Strategies for Management. National Academy Press, Washington, DC.

NatureServe Explorer: An online encyclopedia of life [web application]. 2001. Version 1.6. Arlington, Virginia, USA: NatureServe. Available: http//www.natureserve.org/explorer.

NatureServe, 2001. International Classification of Ecological Communities: Terrestrial Vegetation. Natural Heritage Central Databases. NatureServe, Arlington, VA.

NatureServe. 2002. Notes on Shortleaf Pine Ecosystems and Restoration Efforts in the Southern Appalachians. Prepared for the USDA Forest Service NatureServe, Durham, NC.

NC, 2000. North Carolina's 2000 Section 303(d) List. North Carolina Department of Environment and Natural Resources, Division of Water Quality. http://h2o.enr.state.nc.us/tmdl/PDFs/nc2k_list.pdf

Neihardt, Charlene, 1996. Data from intensive macroinvertebrate and some with fish sampling within Stekoa Creek subwatershed. Unpublished report.

Neihardt, Charlene. 1995, GIS data base development for Chattooga Watershed Ecosystem Project.

Nelson, R.A., G.E. Folk, Jr., E.W. Pfeiffer, J.J. Craighead, C.J. Jonkel, and D.L. Steiger. 1983. Behavior, biochemistry, and hibernation in black, grizzly, and polar bears. Pgs. 284-296 In: Bears-Their Biology and Management; The 5th International Conference on Bear Research and Management, 1980. Intl. Assn. for Bear Res. and Mgmt. 328 pp.

Nenno, E. S., and J. S. Lindzey. 1979. Wild turkey poults feeding activity in old field, agricultural clearings, and forest communities. Trans. Northeastern Sect. Wildl. Soc. 36:97–109.

Nixon, C. M., M. D. McClain, and R. W. Donohoe. 1975. Effects of hunting and mast crops on a squirrel population. J. Wildl. Manage. 39(1):1–25.

NOAA, 2003. Records from National Climatic Data Center at www.noaa.gov.

Noel, J.M., W.J. Platt, and E.B. Moser. 1998. Structural characteristics of old- and second-growth stands of longleaf pine (Pinus palustris) in the Gulf coastal region of the U.S.A. Conservation Biology 12:533-548.

Norcross, T.W., 1936. Handbook of Erosion Control Engineering on the National Forests. US Government Printing Office, Washington, DC. 90 pp.

NRCS, 1982. 1982 SCS Resources Inventory by County in South Carolina. USDA-Soil Conservation Service. Columbia, South Carolina.

NRCS, 1989. 1987 SCS Resources Inventory, South Carolina. USDA-Soil Conservation Service. Columbia, South Carolina.

NRCS, 2003. Federal Standards for Delineation of Hydrologic Unit Boundaries (Proposed). Federal Geographic Data Committee, Version 1.0, March 1, 2002. 52 pages. Cooperative agencies USGS, NOAA, EPA, USFS, BLM, States and others. Updates at www.ftw.nrcs.usda.gov/huc_data.html

Nutt, L. N. 1998. An interim management policy for *Dendroica cerulea*. Clinch Ranger District, USDA Forest Service. 32pp.

Opler, P. A. and V. Malikul. 1992. A Field Guide to Eastern Butterflies. Houghton Mifflin, New York, NY.

Organic Act, 1977. 16 U.S.C. Sections 551, 1601(a), 1602(5)(C), and 1609(a).

Pack, J. C., W. K. Igo, and C. I. Taylor. 1988. Use of prescribed burning in conjunction with thinnings to increase wild turkey brood range habitat in oak-hickory forests. Trans. Northeastern Sect. Wildl. Soc. 44:37–44.

Palik, B., and R. T. Engstrom. 1999. Pages 65-94 in M. L. Hunter, ed. Maintaining biodiversity in forest ecosystems. Cambridge University Press. Cambridge, United Kingdom.

Panel on Watershed Research. 1966. Recommendations for Watershed Research. Office of Water Resources Research. U.S. Department of Interior. Washington, D.C. 21 pp.

Parker, J.R., K. E. Kammermeyer, and R. L. Marchinton. 1992. Wildlife usage of clover plots in the Chestatee Wildlife Management Area. GA J. Sci. 50:160-169.

Patrick T., Georgia Natural Heritage Program. Personal communication.

Patrick T., J.R. Allison and G. A. Krakow. 1995. Protected Plants of Georgia: An information manual on plants designated by the state of Georgia as endangered, threatened, rare, or unusual. Georgia Dept. of Natural Resources. Social Circle, Georgia. 218pp plus appendices.

Patterson, G., 1981. Quantitative geomorphology of drainage basins in Sumter National Forest, South Carolina. U.S. Geological Survey Open-File Report 81-417.

Pelton, M.R.. 1979. Southeast Working Group Report, Pgs. 236-250 In: The Black Bear in Modern North America. The Boone and Crockett Club. Kalispell, MT. 300pp.

Pelton, M.R.. 1989. The impacts of oak mast on black bears in the southern Appalachians, Pgs. 7-11 In: Proceedings of the Workshop on Southern Appalachian Mast Management, Aug. 14-16, 1989, Univ. of Tenn., Knoxville. USDA Forest Service, Cherokee National Forest and Univ. of Tenn. 85pp.

Pelton, M.R.. 2001. American black bear. Pages 224 – 233 in: Wildlife of Southern forests: Habitat and management, James G. Dickson editor. Hancock House publishers, Blaine, WA.

Platt, S.G. and C.G. Brantley. 1997. Canebrakes: An Ecological and Historical Perspective. Castanea 62:8-20.

Platts, W.S., R.J. Torquemada, M.L. Henry, and C.K., Graham, 1989. Changes in salmon spawning habitat from increased delivery of fine sediment to the South Fork Salmon River, Idaho. Transactions of the American Fisheries Society 118:274-283.

Ramey, J. F. 1996. Cerluean Wabler draft habitat management policy. National Forests in North Carolina. USDA Forest Service. 7pp.

Rankin, D.M. 2000. Fisheries investigations in lakes and streams. District 1 Annual Progress Report, South Carolina Department of Natural Resources, Columbia, South Carolina.

Rankin, Dan M. (Fisheries Biologist, South Carolina Department of Natural Resources) 2002. Personal communications with Jeanne Riley, Fisheries Biologist, USDA Forest Service, Francis Marion and Sumter National Forests, Columbia, South Carolina.

Reagan, S. 1990. Habitat use by female black bears in a southern Appalachian bear sanctuary. M.S. Thesis, University of Tennessee, Knoxville. 110 pp.

Reiser, D.W. and R.G. White, 1988. Effects of two sediment size classes on survival of steelhead and Chinook salmon eggs. North American Journal of Fisheries Management 8:432-437.

Reynolds, E.R. and C.L. Leyton. 1967. Research Data for Forest Policy: The Purpose, Methods and Progress of Forest Hydrology. Commonwealth Forestry Institute. Oxford University. Ninth Forestry Conference Paper. 16 pp.

Rhea, J.R. and J.K. Watson. 1994. Evaluation of the Hemlock Wooly Adelgid Infestation on the Shenandoah National Park, 1993. Field Ofc. Rep. 94-1-22. Asheville, NC: U.S. Department of Agriculture, Forest Service, State and Private Forestry Southern Region, Forest Health Unit.

Ribbeck, Kenneth F.; Johnson, Mark K.; Dancak, Ken. 1987. Subterranean clover on southern pine range: potential benefits to game. Journal of Range Management. 40(2): 116-118. [16191]

Rieman, B. and Clayton, J. 1994. Wildlife and native fish: issues of forest health and conservation of sensitive fish species. USDA Forest Service, Rocky Mountain Research Station.

Roberts, T.H. 1993. The ecology and management of wintering woodcocks. Pages 87-97 IN J. R. Longcore and G. F. Sepik (eds). Proceedings of the eighth American woodcock symposium. U.S. Fish and Wildlife Service Biological Report 16. vi + 139 pp.

Rodewald, P. G. and K. G. Smith. 1998. Short term effects of understory and overstory management on breeding birds in Arkansas oak-hickory forests. J. Wildl. Manage 62:1411-1417.

Roehl, J.W., 1962. Sediment source areas, delivery ratios and influencing morphological factors. Publication No. 59 of the IASH Commission of Land Erosion, pp. 202-213.

Rogers, L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. Trans. North. Am. Wildl. And Nat. Resour. Conf. 41:431-438.

Rosenberg, K.V. and T.P. Hodgman. 2000. Partners In Flight Landbird Conservation Plan: Physiographic Area 28: Eastern Spruce-Hardwood Forest. Available online at: http://www.blm.gov/wildlife/pifplans.htm

Rosenburg, K. V., S. E. Barker, and R. W. Rohrbaugh. 2000. An atlas of cerulean warbler populations. Final report to USFWS: 1997-2000 Breding Seasons. Cornell Lab of Ornithology, Ithica, NY.

Rosene, Walter 1985. The Bobwhite Quail, Its Life and Management. The Sun Press, Hartwell Georgia. 418 pp.

Rosgen, Dave. 1996. Applied River Morphology. Published by Wildland Hydrology, Pagosa Springs, CO. Library of Congress Catalog Number: 96-60962.

Runkle. J. R. 1985. Disturbance regimes in temporate forests Pages 17-33 *in* The Ecology of Natural Disturbance and Patch Dynamics. Academic Press, Inc.

Ruth, C. 2001. South Carolina Deer Harvest Report. SCDNR Technical Report.

SAMAB. 1996. The Southern Appalachian Assessment Terrestrial Technical Report. Report 5 of 5. Atlanta: USDA Forest Service, Southern Region. 288 pp.

Sanders, B.M. and D.H. Van Lear. 1988. Pre- and post-bum photo series for pine-hardwood logging slash in the Southern Appalachians. P. 41-48. In Ninth Conference on Fire and Forest Meterology, April 21-24, 1987. San Diego.

Sanders, G.L. 1992. The role of fire in the regeneration of Table Mountain Pine in the Southern Appalachian Mountains. M. S. Thesis, University of Tennessee, Knoxville.

Sauer, J. R., J. E. Hines, and J. Fallon. 2001. The North American Breeding Bird Survey, Results and Analysis 1996-2000. Version 2001.2. U.S. Geological Survey. Paxutent Wildlife Research Center. Laurel MD.

Sauer, J.R., J.E. Hines, J. Fallon. 2001. The North American Breeding Bird Survey, Results and Analysis 1966-2000. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD

Sauer, J.R., J.E. Hines, L. Thomas, J. Fallon, and G. Gough. 2000. The North American Breeding Bird Survey, Results and Analysis 1966 – 1999. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD

SC DHEC, 1998. Watershed Water Quality Assessments of Savannah and Broad River Basins. SC Department of Health and Environmental Control - Technical Reports 002-93 and 001-98.

SC DHEC, 2001. SC Code of Regulations 61-69. Classified Waters. South Carolina Department of Health and Environmental Control. Columbia, SC. 31 pages.

Scatena, F.N. 2000. Drinking Water Quality. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 2, pages 7-25.

SCDHEC, 1998. Stream Classifications For the State of South Carolina, SC Dept. of Health and Environmental Control.

Schroeder, R. L. 1985. Habitat suitability index models: Eastern wild turkey. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.106). 33pp.

Schumm, S. A., M.D. Harvey and C.C. Watson. 1984. Incised Channels, Morphology, Dynamics and Control. Water Resource Publications, Littleton, Colorado. US Library of Congress Catalog Number 83-050243, 200 pages.

Scott, J.A. 1986. The Butterflies of North America. A Natural History and Field Guide. Stanford University Press. Stanford, California.

Scott, M.C., A.J. Clingenpeel, and K.N. Leftwich, 2003. Endemism Sediment Profile. Process Paper for SA Forest Plan Revisions, Institute of Ecology, University of Georgia, Athens, GA, Athens GA, 30602, mscott@sparc.ecology.uga.edu,

Scott, M.C., and G.S. Helfman. 2001. Native invasions, homogenization, and the mismeasure of integrity of fish assemblages. Fisheries 26(11):6-15.

Seehorn, M. E., R. F. Harlow, and M. T. Mengak. 1981. Foods of ruffed grouse from three locations in the Southern Appalachians. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 35:216-224.

Sepik, G.F., R.B. Owen, Jr., and M.W. Coulter. 1981. A landowner's guide to woodcock management in the Northeast. University of Maine Agricultural Experiment Station Misc. Rep. 253. 23 pp.

Servello, F. A., and R. L. Kirkpatrick. 1987. Regional variation in the nutritional ecology of ruffed grouse. J. Wildl. Manage. 51:749-770.

Shreve, Ronald L. (1965) Statistical Law of Stream Numbers, Publication 274, Institute of Geophysics and Planetary Physics, University of California, Los Angeles, Calif 90024. Pages 17-37.

Silvicultural Examination and Prescription Field Book. USDA Forest Service Southern Region. 1988.

Simone, Steve. 1995. Ecological Classification, Mapping, and Inventory for the Chattooga River Watershed. US Forest Service, Chattooga Ecosystem Demonstration Project.

Singer, M.J., J. Blankard, E. Gillogley and K. Arulanandan, 1978. Engineering and Pedological Properties of Soils as They Affect Soil Erodibility. California Water Resource Center, Techical Report No. 166, ISSN 0575-4941. 32 pp.

Slivitzsky, M.S. and M. Hendler. 1964. Watershed Research as a Basis for Water Resources Development. Fourth Canadian Hydrology Symposium Research Council. 10 pp.

Smith, W. and P. Hamel. 1991. Old-growth Temperate Deciduous Forests: legacy or legend. Natural Areas Journal 11(1): 4-6).

Snedecor, G.W. and W.G. Cochran. 1973. Statistical Methods. Sixth Edition. The Iowa State University Press. Ames, Iowa. 593 pp.

South Carolina Forestry Commission, 1994. South Carolina's Best Management Practices for Forestry. South Carolina Forestry Commission in cooperation with Clemson University, Industry and U.S. Forest Service. 64 pages.

South Carolina Forestry Commission, 2000. Best Management Practices for Braided Stream Systems: A Supplement to the 1994 BMP Manual South Carolina Forestry Commission. SC Forestry Commission. Columbia, South Carolina. 23 p.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Terrestrial Technical Report (SAATR). Report 5 of 5. Atlanta: USDA Forest Service, Southern Region. 288pp.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Aquatics Technical Report. Report 2 of 5. Atlanta: USDA Forest Service, Southern Region.

Southern Appalachian Mountains Initiative. 2002. Final Report. Asheville, North Carolina. 171 pp.

Sperduto, M. U. S. Fish and Wildlife Service. Sept. 1998. Personal communication.

Stafford, S. K. 1989. The southern grouse diet in winter. Pages 288-293. in S. Atwater and J. Schnell, eds. Ruffed Grouse. Stackpole Books, Harrisburg, PA.

Stafford, S. K. and R. W. Dimmick. 1979. Autumn and winter foods of ruffed grouse in the southern Appalachians. J. Wildl. Manage. 43:121-127.

Stednick, J.D., 2000. Timber Manageement. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 10, 103-118.

Stern, D. 2000. Protozoan Pathogens *Giaridia* and *Cryptosporidium*. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Appendix D, pages 218-224.

Stiver, W. 1988. Population dynamics and movements of problem black bears in Great Smoky Mountains National Park. Final Tech. Report No. 4 Dept. Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville. 63 pp.

Stoltz, Terry 2002. Setting Prescribed Fire Objectives for Forest Plan Revisions. Draft 09/20/02

Strahler, A.N. 1964. Quantitative Geomorphology of Drainage Basins and Channel Networks. In: Handbook of Applied Hydrology. V.T. Chow (ed.). McGraw-Hill Book Co. New York. Chapter 4:39-76.

Straw, J. A., Jr., D. G. Krementz, M. e. Olinde, and G. F. Sepik. 1994. American Woodcock. Pages 97-114. In: Tacham T. C., and C. E. Braun, Ed. Migratory Shore and Upland Game Bird Management in North America. The International Association of Fish and Wildlife Agencies.

Suthers, H.B., J.M. Bickal, P.G. Rodewald. 2000. Use of successional habitat and fruit resources by songbirds during autumn migration in central New Jersey. Wilson Bulletin 112:249-260.

Swift, L., Jr. 1988. Forest access roads: design, maintenance, and soil loss. In Swank, W.T. and D.A. Crossley (eds.) Forest hydrology and ecology at Coweeta. New York: Springer-Verlag: pp. 325-338.

Tennessee Wildlife Resources Agency. 2000. Strategic Wildlife Resources Management Plan for the Start of the New Millenium, Year 2000-2006. March 30, 2000. Nashville, TN.

Terres, John K. 1980. The Audubon Society encyclopedia of North American birds. New York: Alfred A. Knopf. 1109 p. [16195]

Terwilliger, K. 1991. Virginia's endangered species: proceedings of a symposium. The McDonald and Woodward Publishing Company, Blacksburg, VA.

Thackston, R, T Holbrook, W. Abler, J. Bearden, D. Carlock, D. Forster, N. Nicholson, and R. Simpson. 1991. The wild turkey in Georgia- history, biology, and management. GA Dept. Nat. Resour. 32pp.

The Nature Conservancy (TNC). 1987. Element Stewardship Abstract for *Ribes echinellum*. Arlington, Virginia.

The Nature Conservancy, 1990. Element Stewardship Abstract for Relict Trillium. Columbia, SC. 13 pp

Thompson M. T. 1998. Forest Statistics for North Georgia, 1998. USDA For. Serv. South. For. Exp. Sta. Res. Bull. SRS-35. 59 pp.

Thompson, F. R., III, and D. R. Dessecker. 1997. Management of early-successional communities in central hardwood forests: with special emphasis on the ecology and management of oaks, ruffed grouse, and forest songbirds. USDA For. Serv. Gen. Tech. Rep. NC-195. 33pp.

Thompson, F.R., III, R.M. DeGraff. Conservation approaches for woody, early successional communities in the eastern United States. Wildlife Society Bulletin 29(2):483-494

Tiedemann, A.R. 2000. Wildlife. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Chapter 15, pages 158-163.

Tiner, R.W. 1999. Restoring Wetland and Streamside/Riparian Buffers: An Introduction. U.S. Fish and Wildlife Service, Hadley, MA.

Toebes, C. and R. Ouryraev. 1970. Respresentative and Experimental Basins: An International Guide for Research and Practice. Studies and Reports in Hydrology. No. 4, UNESCO, Paris. 348 pp.

Trani-Griep, M.K. 1999. Early Successional Habitat and Open Lands Assessment for the Eastern and Southern Regions. Report I. August 1999. USDA Forest Service, Atlanta, Ga.

Trimble, S. 1974.

Turrill, N. L., and E. R. Buckner. 1995. The loss of southern Appalachian *Pinus pungens* Lam. due to fire suppression. ASB Bulletin 42:109.

Tuttle, M.D. and Stevenson, D. 1977. Variation in the Cave Environment and its Biological Implications. National Cave Management Symposium Proceedings. Eds. R. Zuber, J. Chester, S. Gilbert, and D. Rhodes. Big Sky, MT, 3-7 October 1977. 15 pp.

Tuttle, M.D. and Taylor, D.A.R. 1994. Bats and Mines. Bat Conservation International, Inc. Resource Publication No. 3. Austin, TX. 41 pp.

U. S. Fish and Wildlife Service. 1984. Persistent Trillium Recovery Plan. U. S. Fish and Wildlife Service, Atlanta, Georgia. 69pp.

U. S. Fish and Wildlife Service. 1992. Small Whorled Pogonia (Isotria medeoloides) Recovery Plan, First Revision. Newton Corner, Massachusetts. 75pp.

U.S. Environmental Protection Agency (U.S. EPA), 1995. National air pollutant emission trends, 1900-1994. EPA-454/R-95-011. Research Triangle Park. NC: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. 64p.

U.S. Environmental Protection Agency (U.S. EPA), 2000b. Aerometric Information Retrieval System. Research Triangle Park, NC: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. http://www.epa.gov/air/data/net.html

U.S. Environmental Protection Agency (U.S. EPA), 2001c b. U.S. EPA Title IV Electric Utility Sources, taken from EPA's TTN website, http://www.epa.gov/ttn/.

U.S. Environmental Protection Agency (U.S. EPA), 2002a. Nonattainment sites, taken from the EPA's website: http://www.epa.gov/oar/oaqps/greenbk/

U.S. Environmental Protection Agency. 1996. Compilations of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I, Supplement B: Stationary and Area Sources.

U.S. Fish and Wildlife Service. 1991. Recovery Plan for Harperella, *Ptilimnium nodosum*. Maryland Field Office.

U.S. Fish and Wildlife Service. 1993. Recovery Plan for Three Granite Outcrop Plants. Jackson, Mississippii. 41 pp.

U.S. Fish and Wildlife Service. 1995. Endangered Species Success Story. Biologue Series.

U.S. Fish and Wildlife Service. 1995. Smooth Coneflower Recovery Plan. Atlanta, GA. 31 pp.

U.S. Fish and Wildlife Service. 1996. Carolina Heelsplitter Recovery Plan. U.S.Fish and Wildlife Service, Atlanta, GA. 30pp.

U.S. Fish and Wildlife Service. 1996. Revised recovery plan for the U.S. breeding population of the wood stork. U.S. Fish and Wildlife Service. Atlanta, Georgia. 41p.

U.S. Fish and Wildlife Service. 1999. Proposed rule to remove the Bald Eagle in the lower 48 states from the endangered and threatened wildlife. Federal Register 64:36453-36464.

U.S. Fish and Wildlife Service. 2000. Technical/Agency Draft Revised Recovery Plan for the Red-cockaded Woodpecker (Picoides borealis). U.S. Fish and Wildlife Service. Atlanta, GA. 229 p.

U.S. Geological Survey. Approx. 1940-1999. Water Resource Data for Georgia and South Carolina for the Chattooga River and other north Georgia streams.

U.S. Geological Survey. Approx. 1940-2000. Water Resource Data for Georgia and South Carolina for the Chattooga River gaging station and for shorter durations on other streams including Stekoa Creek, Warwoman Creek, West Fork Chattooga River and North Fork Chattooga River. US Geological Survey. Atlanta, GA.

US Federal Register: July 18, 1985. Determination of Threatened Status for *Ribes echinellum* (Miccosukee Gooseberry) - Final Rule. Washington: U.S. Department of the Interior, Fish and Wildlife Service. 67 (127): 44502 - 44522.

US Federal Register: July 2, 2002. Designation of Critical Habitat for the Carolina Heelsplitter – Final Rule. Washington: U.S. Department of the Interior, Fish and Wildlife Service. 67 (127): 44502 - 44522.

USDA Forest Service, Animal and Plant Health Inspection Service. 1995. Final Environmental Impact Statement Gypsy Moth Management in the United States: A Cooperative Approach. Washington D.C.

USDA Forest Service, Southern Region. 1999. Noxious Weed Management Strategy Southern Regional Office, Atlanta, GA.

USDA Forest Service, Southern Region. 2001. Regional Invasive Exotic Plant Species List. Southern Regional Office, Atlanta, GA.

USDA Forest Service. 1965. Silvics of forest trees of the United States. Agriculture Handbook Number 271, Washington, DC.

USDA Forest Service. 1997. Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region. Report of the Region 8 Old-Growth Team. USDA Forest Service Southern Region. Forestry Report R8-FR 62.

USDA Forest Service. 1971. Chattooga Wild and Scenic River Study Report. Forest Service, Southern Region.

USDA Forest Service. 1990. Silvics of North America, Vol. 2: Hardwoods. USDA Forest Service. Agriculture Handbook No. 654. 877pp.

USDA Forest Service. 1995. Final Environmental Impact Statement For the Management of the Red-cockaded woodpecker and its Habitat on the National Forests in the Southern Region. Management Bulletin R8-MB 73. 407 p.

USDA Forest Service. 1996. Analysis of Outstanding and Remarkable Values of the Chattooga Wild and Scenic River 1971-1996. Francis Marion and Sumter National Forests, Columbia, South Carolina.

USDA Forest Service. 1997. Guidance for Conserving and Restoring Old- Growth Forest Communities on National Forests in the Southern Region. Report of the Region 8 Old-Growth Team. Forestry Report R8-FR 62. U.S. Department of Agriculture, Forest Service, 1720 Peachtree Road, NW, Atlanta, GA, 30367. 118 pp. plus two appendices.

USDA Forest Service. 1997. Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region. Report of the Region 8 Old-Growth Team. Forestry report R8-FR 62. Southern Region Atlanta, GA.

USDA Forest Service. 2001. Southern Forest Resource Assessment. Chapter HLTH-1: Forest Area and Condition. USDA Forest Service, Southern Research Station and Southern Region. Draft Report.

USDA Forest Service. 2001. Southern Forest Resource Assessment. Chapter HLTH-1: Forest Area and Condition. USDA Forest Service, Southern Research Station and Southern Region. Draft Report.

USDA Forest Service. 2001. Southern Forest Resource Assessment. USDA Forest Service, Southern Research Station and Southern Region. Draft Report.

USDA Forest Service. 1989. Restoring a trout stream. The Reed Creek Story on the Chattahoochee. Chattahoochee-Oconee National Forest: Soil, Water and Fisheries Sections. Unpublished report.

USDA Forest Service. 1997. Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region. Report of the Region 8 Old-Growth Team. USDA Forest Service Southern Region. Forestry Report R8-FR 62.

USDI Fish and Wildlife Service. 2000. Memo from Jamie Rappaport Clark to Regional Directors re: Service Guidance on the Siting, Construction, Operation and Decommissioning of Communications Towers. September 14, 2000. Washington, DC.

USGS. Various years and stations. Water Resources Data for South Carolina and Georgia. Published Water-Data Reports and website data files through www.usgs.gov.

Van Lear, D.H. and J.E. Douglass. 1982. Water in the loblolly pine ecosystem - Eastern Region. P. 285-296. In Proceedings of the Symposium on the Loblolly Pine Ecosystem. Raleigh, NC. 335 pp.

Van Lear, D.H. and P.R. Kapeluck. 1989. Fell and bum to regenerate mixed pine-hardwood stands: an overview of effects on soil. P. 83-90. In Waldrop, T.A. (Ed.) Proceedings of Pine-hardwood Mixtures: A Symposium on Management and Ecology of the Type. USDA Forest Service General Technical Report SE-58. Asheville, NC.

Van Lear, D.H. and S.J. Danielovich. 1988. Soil movement after broadcast burning in the Southern Appalachians. Southern Journal of Applied Forestry 12: 49-53.

Van Lear, D.H. and T.A. Waldrop. 1989. History, uses, and effects of fire in the Appalachians. USDA Forest Service General Technical Report SE-54. 20 pp.

Van Lear, D.H. and V.J. Johnson. 1983. Effects of prescribed burning in the Southern Appalachian and upper Piedmont forests: A review. Clemson University Department of Forestry Bulletin No. 36. 8 pp.

Van Lear, D.H., G.B. Taylor and W.F. Hansen (1995). Chattooga Watershed Sediment Source Road Survey. Clemson Univsity, Trout Unlimited and US Forest Service were contributors to this data collection and analysis.

Van Lear, D.H., J.E. Douglass, S.K. Cox, and M.K. Augspurger. 1985. Sediment and nutrient export in runoff from burned and harvested pine watersheds in the South Carolina Piedmont. Journal of Environmental Quality 14: 169-174.

Van Lear. D.H. 1985. Prescribed fire-its history, uses, and effects in southern forest ecosystems. P. 57-75. In Wade, D.D. (Comp.) Prescribed Fire and Smoke Management in the South: Conference Proceedings. 1984 September 12-14, Atlanta, GA. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, NC.

Vaughan, M. 1996. Personal Communication. Annual report on the progress of the Cooperative Allegheny Bear Study. Unpublished meeting notes.

Vaughan, M. 1999. Personal Communication. Review of draft report.

Wagner, S., J. PLissner, S. Gauthreaux, Jr., and W. Jarvis. 1994. Clear-cut--longleaf pine regeneration. J. Field Ornith. 65:125-126 (supplement).

Walsh, S.W., N.W. Burkhead, and J.d. Williams. 1995. Southeastern freshwater fishes. Pages 144-147 *in* E.T. LaRoe, ed. Our living resources. A report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of Interior, national Biological Service, Washington, D.C.

Ward, R.C. 1971. Small Watershed Experiments: An Appraisal of Concepts and Research Developments. University of Hull. England. 254 pp.

Ware, S., C. Frost, and P.D. Doerr. 1993. Southern mixed hardwood forest: the former longleaf pine forest. Pp. 447-493 in W.H. Matin, S.G. Boyce, and A.C. Echternacht, eds. Biodiversity of the southeastern United States: lowland terrestrial communities. John Wiley and Sons, Inc., New York, NY.

Wathen, G. 1983. Reproduction and denning of black bears in the Great Smoky Mountains. M.S. Thesis, University of Tennessee, Knoxville. 135 pp.

Wear, D.N. and J.G. Greis, eds. 2002. Southern Forest Resource Assessment. Gen. Tech. Rep. SRS-53. Asheville, NC: US Department of Agriculture. Forest Service, southern Research Station. 635 pp.

Wear, D.N. and J.G. Greis. 2001. The Southern Forest Resource Assessment Summary Report. Draft: November 2001. USDA Forest Service, Atlanta, Ga.

Webb, J.R., F. Deviney, J. Galloway, C. Rhinehart, P. Thompson and S. Wilson. 1994. The Acid-Base Status of Native Brook Trout Streams in the Mountains of Virginia: A Regional Assessment Based on the Virginia Trout Stream Sensitivity Study. Department of Environmental Sciences, University of Virginia, Charlottesville, VA.

Weber, Louise and Jeffery Isley, 1995. Water Quality Assessment using a Macroinvertebrate Biotic Index. Unpublished lab report on Chattooga River Ecosystem Demonstration macroinvertebrate work. Jenny Adkins and Kyle Burrell led the sampling effort for the US Forest Service. Clemson University and the US Forest Service. Unpublished report.

Weber, Louise and Jeffery Isley, 1995. Water Quality Assessment using a Macroinvertebrate Biotic Index. Unpublished lab report on Chattooga River Ecosystem Demonstration macroinvertebrate work.

Welch, N. I. and Waldrop T. A. 2001. Restoring Table Mountain Pine *(Pinus pungens* Lamb.) communities with prescribed fire: an overview of current research. Castanea. 66(1-2): 42-49

Wentworth, J. M., A. S. Johnson, and P. E. Hale, and K. E. Kammermeyer. 1990b. Seasonal use of clearcuts and food plots by white-tailed deer in the Southern Appalachians. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 44:215-223.

Wentworth, J. M., A. S. Johnson, and P. E. Hale. 1989. Influence of acorn abundance on white-tailed deer in the Southern Appalachians. Pages 2-6 in C. E. McGee, ed. Proceedings workshop Southern Appalachian mast Management. USDA For. Serv. and Univ. Tennessee.

Wentworth, J. M., A. S. Johnson, and P. E. Hale. 1990a. Influence of acorn use on nutritional status and reproduction of deer in the Southern Appalachians. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 44:142-154.

Wentworth, J. M., A. S. Johnson, P. E. Hale, and K. E. Kammermeyer. 1992. Relationships of acorn abundance and deer herd characteristics in the Southern Appalachians. South. J. Appl. For. 16: 5–8.

Whitehead, C.J.. 1989. Mast yields, variation in production, and methods of measurement, Pgs. 28-36 In: Proceedings of the Workshop on Southern Appalachian Mast Management, Aug. 14-16, 1989, Univ. of Tenn., Knoxville. USDA Forest Service, Cherokee National Forest and Univ. of Tenn. 85pp.

Whitney. G.G. 1986. Relation of Michigan's presettlement pine forests to substrate and disturbance history. Ecology 67: 1548-1559

Whittington, R. W. 1984. Piedmont Plateau. Pages 355-366. in L. K. Halls, ed. Whitetailed Deer: Ecology and Management. Stackpole Books, Harrisburg, Pa.

Wiggers, E. P., M. K. Laubhan, and D. A. Hamilton. 1992. Forest structure associated with ruffed grouse abundance. For. Ecol. and Manage. 49:211-218.

Wilderness Act, 1997. 36 C.F.R. 293.2

Wilm, H.G. 1943. Statistical Control of Hydrologic Data from Experimental Watersheds. American Geophysical Union Transactions. Volume 2:618-624.

Wolff, J. O. 1996. Population fluctuations of mast-eating rodents are correlated with production of acorns. J. Mammal. 77:850-856.

Wolman, W.G. 1954. A Method of Sampling Coarse River-bed Material. Transactions of American Geophysical Union 35: 951-956.

World Wide Web reference. http//:www.towerkill.com. July 6, 2002.

Wunz, G. A., and J. C. Pack. 1992. Eastern Turkey in eastern oak-hickory and northern hardwood forests. Pages 232-264. in J. G. Dickson, ed. The Wild Turkey: Biology and Management. Stackpole Books, Harrisburg, PA.

Yarrow, G. K. and D. T. Yarrow. 1999. Managing Wildlife. Sweetwater Press, Birmingham, Al.

Yoho, N.S, 1980. Forest Management and Sediment Production in the South - A Review. Southern Journal of Applied Forestry, Volume 4, Number 1. pp. 27-35.

Zalants, M.G., 1991. Low-Flow Characteristics of Natural Streams in the Blue Ridge, Piedmont, and Upper Coastal Plain Physiographic Provinces of South Carolina. US Geologic Survey, Water-Resources Investigations Report 90-4188, in cooperation with SC Department of Health and Environmental Control. Columbia, SC. 92 pages.

Zartman, C. and J. Pittillo. 1995. An Inventory of Spray Cliff Plant Communities in the Chattooga Basin. USDA Forest Service and Highlands Biological Station, Western Carolina University. Burns, Russel M. and Honkala, Barbara H. 1990. Silvics of North America, Volume 1. USDA Forest Service, Agricultural Handbook 654.

Zipperer, W.C., K. Solari, and B.A. Young, 2000. Urbanization. In Drinking Water from Forests and Grasslands: A Synthesis of the Scientific Literature. G. E. Dissmeyer, Editor. USDA Forest Service General Technical Report SRS-39. Pages 62-73.

Zobel, D. B. 1969. Factors affecting the distribution of *Pinus pungens***,** an Appalachian endemic. Ecol. Monogr. 39:303-333.

Index

Please refer to the Table of Contents.

Final Environmental Impact Statement for the Revised Land and Resource Management Plan

Sumter National Forest

Appendixes Final Environmental Impact Statement for the Revised Land and Resource Management Plan

Sumter National Forest

Revised Land and Resource Management Plan

Sumter National Forest