FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR THE

REVISED LAND AND RESOURCE MANAGEMENT PLAN

OZARK-ST. FRANCIS NATIONAL FORESTS

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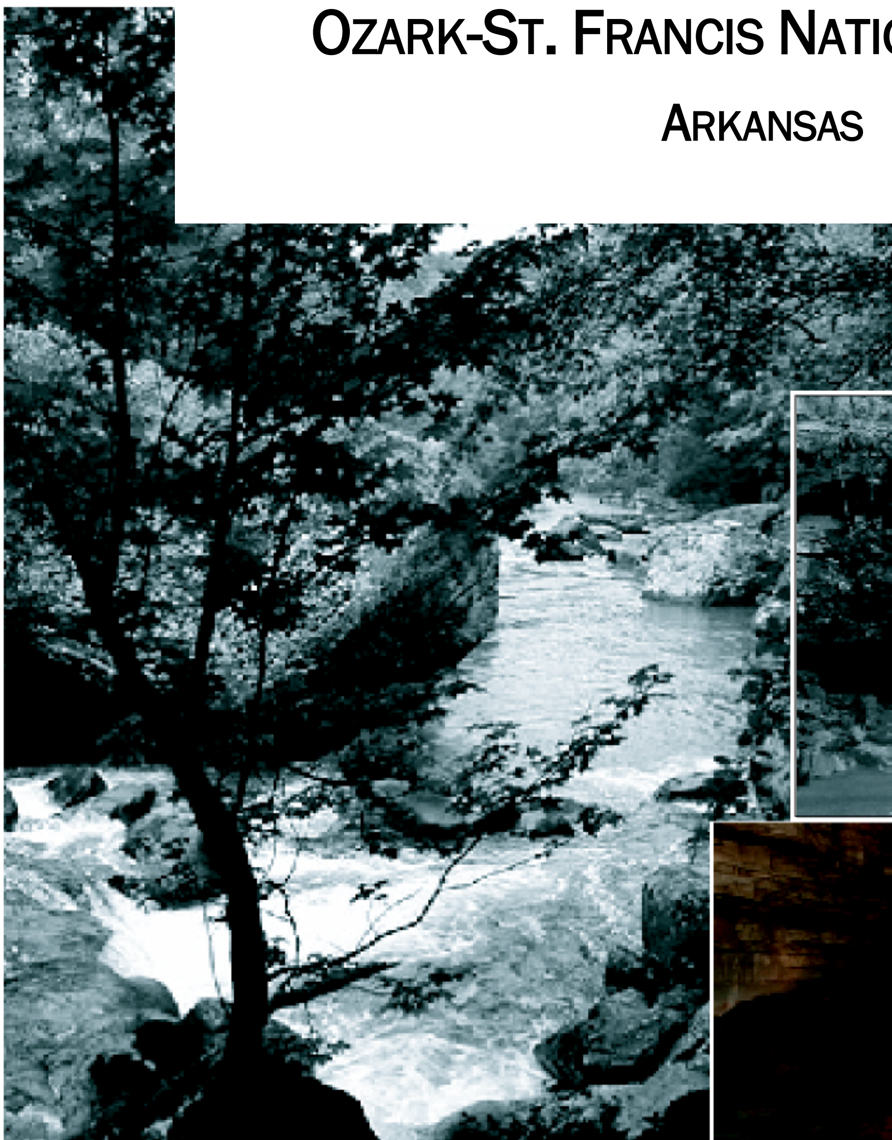

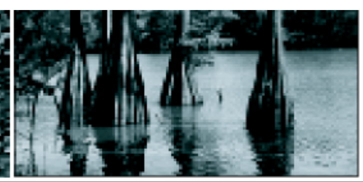

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Final Environmental Impact Statement

For The

Revised Land and Resource Management Plan

Ozark-St. Francis National Forests

Baxter, Benton, Conway, Crawford, Franklin, Johnson, Logan, Madison, Marion, Newton, Pope, Searcy, Stone, Van Buren, Washington, Yell, (Ozark National Forest) Lee, and Phillips (St. Francis National Forest) Counties in Arkansas

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Abstract

This Environmental Impact Statement describes five alternatives and their environmental consequences for revising the Land and Resource Management Plan (Forest Plan) for the Ozark-St. Francis National Forests. It includes a "no action" alternative, which would continue managing the land and resources of the Ozark-St. Francis National Forests under the 1986 Forest Plan as amended. The alternatives provide different mixes of goods and services through various goals, objectives, management areas, standards, and monitoring requirements for the planning period (10 to 15 years) beginning with the approval of the Revised Plan. Revised management direction is developed for all of the lands and resources on the Ozark-St. Francis National Forests.

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Appendices Are Found in a Separate Document:
(Appendices of the Final Environmental Impact Statement)

CHAPTER 1
PURPOSE AND NEED

INTRODUCTION

The United States Department of Agriculture (USDA) Forest Service (FS) has prepared this Final Environmental Impact Statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This FEIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five chapters:

- **CHAPTER 1. PURPOSE AND NEED FOR ACTION:** This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the USDA FS informed the public of the proposal and how the public responded.

- **CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION:** This chapter provides a more detailed description of the Agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. Finally, this section provides summary tables of the environmental consequences associated with each issue.

- **CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES:** This chapter describes the environmental effects of implementing the proposed action and other alternatives.

- **CHAPTER 4. PREPARERS:** This chapter provides a list of preparers and agencies consulted during the development of the final environmental impact statement.

- **CHAPTER 5. DISTRIBUTION LIST:** This is a list of individuals and organizations that have been sent a copy of the FEIS and Revised Land and Resource Management Plan.

- **APPENDICES:** The appendices provide more detailed information to support the analyses presented in the FEIS.

PROPOSED ACTION

The purpose of this proposed action is to revise the Land and Resource Management Plan (LRMP) for the Ozark-St. Francis National Forests. The revised LRMP guides all natural resource management activities on the Ozark-St. Francis National Forests (OSFNFs) 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 LRMP for the OSFNFs was approved July 1986. As of FY 2004, the existing LRMP has been amended 13 times. Revision of the LRMP is now needed to satisfy regulation requirements and to address new information about the forests and their uses.

The regulations implementing the National Forest Management Act (NFMA) instruct the Regional Forester to make periodic revisions to LRMP 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 five alternatives for revising the LRMP of the OSFNFs 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 (LRMP)—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 LRMP-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 Land and Resource Management Plan include:

- Establishment of the forest-wide multiple-use goals and objectives [36 CFR 219.11(b)].
- Establishment of forest-wide management requirements [36 CFR 219.13 to 219.27].
- Establishment of multiple-use prescriptions and associated standards for each management area [36 CFR 219.11(c)].
- Determination of land that is suitable for the production of timber [16 U.S.C. 1604(k) and 36 CFR 219.14].
- Establishment of allowable sale quantity for timber within a time frame specified in the plan [36 CFR 219.16].
- Establishment of monitoring and evaluation requirements [36 CFR 219.11(d)].
- Recommendation of roadless areas as potential wilderness areas [36 CFR 219.17].
- Where applicable, identify those lands which are administratively available for leasing [36 CFR 228.102 (d)] and when appropriate, authorize the Bureau of Land Management to offer those specific lands for lease [36 CFR 228.102 (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 LRMP.

SUPPORTING ENVIRONMENTAL IMPACT STATEMENTS

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

- *Final Environmental Impact Statement for the Suppression of the Southern Pine Beetle* (USDA Forest Service, Southern Region 1987)
- *Final Environmental Impact Statement for RARE II* (USDA Forest Service, Southern Region 1979)
- *Final Environmental Impact Statement for Vegetation Management in the Ozark-Ouachita Mountain* (USDA Forest Service, Southern Region 1990)
- *Final Environmental Impact Statement, Wild and Scenic River Study Report on Thirteen Rivers in the Ozark National Forest (*USDA Forest Service, Ozark National Forest 1991)
- *Ozark-Ouachita Highlands Assessment* (USDA Forest Service, Southern Region 1999)
- *Final Environmental Impact Statement for Forest Service Roadless Area Conservation* (USDA Forest Service, Washington Office 2000)
- *Southern Resource Assessment* (USDA Forest Service, Southern Region 2002)

FOREST PROFILE

Located in a land of rolling hills and mountains primarily in Northwest Arkansas, the Ozark National Forest was created by President Theodore Roosevelt in 1908. The Ozark National Forest is divided into six ranger districts and one job corps located in 16 counties. It contains six geographical units in Northwest Arkansas: Wedington, Lee Creek, Main Division, Magazine, Sylamore, and Henry R. Koen Experimental Forest. The 1.2 million acres of forest consist of two-thirds mixed oak and hickory hardwood and one-third shortleaf pine forest ecosystems. The Ozark National Forest is characterized by steep slopes with vertical sandstone and limestone bluffs.

The St. Francis National Forest is located in two counties in eastern Arkansas and derives its name from the St. Francis River. Most of the forest is situated on Crowley's Ridge but a portion is in the low flatlands along the Mississippi River. The St. Francis National Forest, one of the smallest national forests, covers 21,000 acres.

The St. Francis National Forest was established in 1960 when it was administratively combined with the Ozark National Forest.

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 three 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."

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 to 8 are described in this document. Refer to Appendix A, "Summary of Public Involvement" and Appendix B, "The Analysis Process," for more detail on the results of these steps.

SUMMARY OF SIGNIFICANT ISSUES

The following issues and planning questions were used to develop alternatives for the forest plan revision process.

1. **Mix of Recreation Opportunities**
   The Forests need to determine the mix of developed and dispersed recreation, the type of development, settings, and services to provide in the next 15 years.

2. **Public Access**
   The Forests need to determine the combination of land allocation for public access, open and closed roads, and motorized travel to minimize conflict among users, provide recreation opportunities, and protect the resources.

3. **Special Areas**
   The Forests need to determine what special areas are needed. Some examples are: wild and scenic rivers, special interest areas, wildernesses, scenic byways, research natural areas (RNAs), and experimental forests.

4. **Ecosystem Health and Sustainability**
   The Forests need to determine what actions and land allocations are needed to ensure the health of ecosystems while considering plant, animal, and human interaction.

5. **Relationship of National Forest Management to Communities and Economies**
   The issue is how to balance the economic and social needs of the public while managing for forest health and sustainability.

PLANNING PROCESS RECORDS

The Ozark-St. Francis National Forests 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 FEIS 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:

Supervisor's Office
Ozark-St. Francis NFs
605 West Main Street
Russellville, AR 72801
Telephone: 479-964-7200

CHAPTER 2
ALTERNATIVES

INTRODUCTION

This chapter summarizes and compares the alternatives that were developed as potential management strategies for the Ozark-St. Francis National Forests (OSFNFs). Alternatives provide a framework for analyzing different ways of meeting the purpose and need and for addressing the issues in Chapter 1. This chapter describes in detail the five alternatives considered in this Environmental Impact Statement, as well as the process used to develop the alternatives, and how they respond to the significant issues identified in Chapter 1. This chapter also describes the "no action" alternative that would continue current management direction, discusses how the alternatives conform to national and regional direction, and describes why some alternatives were originally considered and later eliminated from detailed study.

All of the alternatives were designed to be fully implementable and achievable and to meet the purpose and need of the Revised Forest Plan. They all address the significant issues described in Chapter 1. While all alternatives provide a wide range of multiple uses, goods, and services, each alternative has a different approach to how they address the significant issues.

ALTERNATIVE DEVELOPMENT

The alternative development process consisted of four different phases and involved a cooperative effort with the public and Forest Service employees. The public involvement strategy used to develop the alternatives is summarized in Chapter 1 and detailed in Appendix A.

Phase I developed alternative themes. Alternative themes are broad and general descriptions of management direction that suggests a particular emphasis toward particular resources, uses, or conditions. Each theme proposes a different strategy for addressing the significant issues summarized in Chapter 1. The Interdisciplinary Team (IDT) also considered other associated factors including social considerations and the capability of the land to support different management activities. The four themes developed are:

> **Theme A**: Priority is given to producing cost-effective goods and services beneficial to local communities and economies.

Theme B: Priority is given to restoring natural resource processes and ecosystems.

Theme C: Priority is given to balancing age classes across the Forests.

Theme D: Priority is given to balancing the wide diversity of interests and values in management of the Forests using a mix of vegetation management practices.

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

In Phase III, these themes were posted on the Forest web site, mailed to interested parties, and summarized in the Forest Planning newsletter, *The Ozark Connection*. Three public meetings and a series of meetings with Ozark-St. Francis National Forests employees were held in March 2004 to gather additional input and further refine the themes and maps. Comments from the public were solicited.

Phase IV analyzed the comments to determine whether modifications to the alternative direction or allocations were needed and whether other alternatives need to be developed. Based on public input, the original four alternative themes (with some modifications) became Alternatives B through E, and the Current Direction (No Action) Alternative became Alternative A. No additional alternatives were developed.

CONSISTENCY WITH RESOURCES PLANNING ACT

The National Forest Management Act (NFMA) regulations at 36 CFR 219.12(f)(6) require the Forest Plans to respond to and incorporate the Renewable Resource Planning Act (RRPA) objectives. The last RRPA Program was developed in 1995. Currently, the Forest Service Strategic Plan (2004-2008) provides the overarching national guidance for forest planning, national objectives, and the Agency as required by the Government Performance and Results Act. All of the alternatives in this EIS incorporate these broad objectives.

ALTERNATIVES ELIMINATED FROM DETAILED STUDY

Six alternatives in addition to current management direction were considered during the alternative development process. Two alternatives were eliminated from detailed study. One alternative was developed internally; an outside group proposed the other. Many aspects of these themes are incorporated into other alternatives. The following briefly describes each of the alternatives that were not studied in detail and discusses the reasons for their elimination. These alternatives are labeled by their major emphasis.

MINIMUM MANAGEMENT ALTERNATIVE

This alternative 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.

Within a few decades, potential old-growth areas would come to represent the majority of the forests because of minimal management activity. There would be no regular, periodic harvest of green timber; therefore, no "suitable" forestland. 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.

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. Roads not needed for legal requirements and other resource needs would be closed or obliterated.

Reasons Minimum Management Alternative Was Eliminated From Detailed Study

After considering this preliminary information, it was determined that Minimum Management Alternative did not need to be further evaluated in detail in this FEIS. The reasons are:

- After further analyses, it was determined that this alternative, as originally envisioned, would not meet all the legal requirements of the National Forest Management Act (NFMA) of 1976, the Multiple-Use Sustained-Yield Act (MUSYA) of 1960, and the Endangered Species Act (ESA) of 1973.

- This alternative does not address all the forest planning issues that have been identified by the public.

- Another alternative (Alternative B) considered in detail provides for relatively low levels of management activities.

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 the 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 on the OSFNFs including an analysis of the current situation and changing public values as represented by the five issues.

This alternative, 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 plan 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 MUSYA 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," this alternative 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. As is explained in Chapter 3 of this FEIS, 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 this alternative.

With respect to the Agency's "Healthy Forests Initiative," a management emphasis to change the situation where forests would be overloaded with fuels, and vulnerable to severe wildland fires, would not lead to a healthy forest. 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. This alternative 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 medium to 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 B, C, D, and E.

While this alternative addresses some of the issues, there are other management issues that have been raised by the public that are not addressed. In addition to the forest health and wildlife habitat management concerns expressed above, this alternative 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 alternative would not meet the requirements for the "minimum benchmark levels."

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

SIERRA CLUB ALTERNATIVE

The Sierra Club presented this alternative. This alternative is entitled the "The Citizens' Forest Plan." The Sierra Club requested that this plan be adopted by the U.S. Forest Service to guide the management of the Ouachita and Ozark-St. Francis National Forests. The full text of the Sierra Club's proposal is included in the process record and available for public review. The following summarizes the major points of the Sierra Club's alternative that affects the Ozark-St. Francis National Forests:

- **Wild and Scenic Streams**
  Designate the Illinois Bayou; the North, East, and Middle Forks of the Illinois Bayou; Falling Water Creek; East Fork of the Little Buffalo River; and Cole Fork Branch. No logging, road building, road construction, or road reconstruction of any kind will be allowed within the complete watershed of any designated wild and scenic stream.

- **Wilderness**
  Roadless Area Review and Evaluation II (RARE II) areas should be reexamined for qualification as wilderness areas. Additions to existing wilderness areas consisting of qualified adjacent lands should also be examined. The U.S. Forest Service should also work to expand its protected lands category by including other semi-roadless and special interest areas for protection.

- **Large Conservation Areas**
  Large and contiguous areas of up to 500,000 acres should be set aside for conservation, watershed protection, and wildlife preservation purposes. No logging, additional road construction, or road reconstruction of any kind will be allowed in these areas. Motorized recreation will be allowed but only on open and/or designated roads or trails.

- **Recreation**
  Both concentrated and dispersed recreational activities will be emphasized to the extent that they do not harm the forest environment or its wildlife.

- **Off Road Vehicles**
  ORVs use should be restricted to open roads and/or designated trails.

- **Fire**
  Burning in the national forests can still continue as a natural tool, but will be conducted only where site-specific data exist that show a natural propensity for fire and with a site-specific burning cycle that will mimic prehistoric conditions.

Fire will not be used as a tool to artificially manipulate forest plant species composition. Fires started by lightning strikes will be given preference in allowing a natural burn to continue unless it threatens private property or if environmental or weather conditions cause it to become dangerous.

- **Natural Biodiversity**
  All timber or wildlife management or fire activity will ensure that the native biodiversity of the OSFNFs will be maintained and/or reestablished. Timber or wildlife management activities will not be used to artificially manipulate the species composition of either forest for commercial or extractive reasons.

- **Forest Pests**
  The Ozark–St. Francis National Forests will emphasize the return of the Forests to their documented natural biodiversity in order that forest pest infestations can be minimized and/or eliminated. Where the Forest Service has managed the Forests to change the natural biodiversity into monoculture stands of pine, those stands will be managed to return them to a natural pine-hardwood mixture with natural competition being the preferred management tool.

- **Free Flowing Streams**
  No free-flowing section of a stream or any free-flowing stream on national forest lands will be dammed and/or impounded for any reason.

Reasons Sierra Club Alternative Was Eliminated from Detailed Study

This alternative was not analyzed in detail for the following reasons:

After reviewing the Citizens' Alternative, it was felt that most of the proposals are already incorporated into the full range of Alternatives B, C, D, and E.

- **Wild and Scenic Rivers**
  Amendment 7 of the Current Forest Plan established corridors for six wild and scenic rivers designated by Congress in 1992. The river suitability study conducted to determine whether those rivers were suitable for designation included other rivers. During this plan revision, the original study was used to determine if anything had changed to recommend the other rivers for designation.

  The North Fork of the Illinois Bayou had circumstance that changed. In 1990, the city of Russellville was studying building a water impoundment on the North Fork of the Illinois Bayou River. Since that time, the city developed a water source on Huckleberry Creek, outside the forest boundary. Alternatives B, C, and E include the North Fork as a proposed wild and scenic river addition. Other rivers such as Cole Fork Branch, East Fork of the Little Buffalo, and Falling Water Creek were reviewed. The study pointed out Cole Fork Branch was inside the Clifty Canyon Special Interest Area (SIA). Current Forest Plan direction provides adequate protection of the outstandingly remarkable values for that

river. The existing SIAs, including Clifty Canyon, are proposed in all alternatives in the Revised Plan under Management Area 1.G. This management area provides adequate protection of the rivers' outstandingly remarkable values. For these reasons, Cole Fork Branch is not being re-considered for recommendation. Falling Water Creek and the East Fork of the Little Buffalo were not recommended because they did not have enough outstandingly remarkable values to warrant recommendation. This situation has not changed, and these rivers are not recommended. The OSFNFs reviewed other rivers considered during that study as well, and nothing has changed to merit any further recommendations.

- **Wilderness**
  An inventory of roadless areas was completed for this revision. The criteria in Chapter 7 FSH 1909.12 were used to determine if roadless areas exist, and if so, should these areas be recommended for further study. That inventory included all the original 1979 RARE II areas as well as adjacent lands. Some adjacent acquired lands are included as areas recommended for designation in alternatives C and E. The results of that inventory can be found in Appendix C.

  Management Areas 2.D and 2.F, the Upper Buffalo and Indian Creek Dispersed Recreation Areas, are proposed as motorized and non-motorized recreation areas in Alternatives C and E. Four additional SIAs are proposed in Alternatives C and E.

- **Large Conservation Areas**
  Alternative B has a custodial management area (0.A.) of over 500,000 acres where timber harvest, prescribed fire, wildland fire use, and integrated pest management are only used to provide for safety and legal requirements. Access is provided primarily through existing state roads and forest service arterial and collector roads.

- **Recreation**
  In all alternatives, both concentrated and dispersed recreational activities are emphasized to the extent that they do not harm the forest environment or its wildlife.

- **Off-Highway Vehicle (OHV) Use**
  OHV use is limited to designated roads and trails in all alternatives. All alternatives close the St. Francis National Forest and the Wedington Unit on the Ozark National Forest to OHV use. This is more restrictive than what is proposed in the Citizens' Alternative.

- **Fire**
  The direct, indirect, and cumulative effects of different amounts of prescribed fire are analyzed in all alternatives in this FEIS. A separate Environmental Impact Statement (EIS) to determine the effects of fire on the ecosystem would most likely find similar results as this FEIS.

- **Natural Biodiversity**
  All alternatives consider biodiversity. Of the five significant issues, Issue 4 (Ecosystem Health and Sustainability), is a major part of the analysis in this FEIS. That issue is broken down into five sub-issues. Biodiversity is number one on the list and is considered in all alternatives.

- **Forest Pests**
  Of the five significant issues, Issue 4 (Ecosystem Health and Sustainability), is a major part of the analysis in this FEIS. This issue is broken down into five sub-issues. Maintenance of the forest ecosystem health and vitality is Sub-Issue 3. All alternatives consider the effects of the proposed management strategies on maintenance forest health. The effects on both the pine and hardwood forests are analyzed in the alternatives considered.

- **Free Flowing Streams**
  The free flowing nature of all six Wild and Scenic Rivers on the OSFNFs are protected by Congressional designation. Any other proposal to dam or impound any other stream would require a separate environmental analysis. No such proposals are included in any of the alternatives considered.

ALTERNATIVES CONSIDERED IN DETAIL

Common to All Alternatives

Forest plans and all national forest management activities must conform to established public policy expressed in federal statutes and administrative directives as well as applicable state law and regulations. In addition, local forests in consultation with the public may commit to priorities that will guide all other decisions. Some common themes, therefore, will be found in each alternative of the Forest Plan. Every alternative will meet the management requirements of 36 CFR 219.27, and any other legal and regulatory requirements. These requirements guide the development, analysis, approval, implementation, and evaluation of forest plans, as well as:

- Maintain basic soil, air, water, and land resources.
- Seek to maintain the viability of all native and desired non-native plants, fish, and wildlife that occur on National Forest System lands.
- Protect and manage threatened and endangered species according to recovery plans.
- Provide recreational opportunities and maintain scenic quality in response to the needs of forest users and local communities.
- Protect heritage resources in accordance with applicable laws and regulations.

- Meet the minimum health and safety standards.
- Include the concepts of multiple-use, sustained yield, and ecosystem management.
- Identify lands available for oil and gas leasing.
- Respect the exercise of private mineral rights to explore and develop mineral resources.
- Recognize the unique status of American Indians and their rights retained by treaty with the United States.
- Allow Off-Highway Vehicles (OHVs) only on designated roads and trails.
- Close the St. Francis National Forest and Wedington Unit on the Ozark National Forest to OHV use.
- Retain the following areas specifically designated in 1986 Forest Land and Resource Management Plan
    - Henry R. Koen and Sylamore Experimental Forests
    - Turkey Ridge and the Dismal Hollow Research Natural Areas
    - North Sylamore Creek, Buffalo River, Hurricane Creek, Richland Creek, Big Piney Creek, and Mulberry River Wild and Scenic Rivers
    - Upper Buffalo, Hurricane Creek, Richland Creek, East Fork, and Leatherwood Wildernesses

Alternative A – No Action Alternative – Current Management

- Continues implementing the 1986 Forest Plan, as amended.
- Provides a variety of developed and dispersed recreation opportunities.
- Manages and protects critical habitat for threatened, endangered, and sensitive species.
- Provides a variety of wildlife habitat across the landscape.
- Strives for a balanced age-class distribution.
- Emphasizes high quality sawtimber.
- (Majority of the Forests is accessible by road.) Retains essentially the same number of roads.
- Allows OHVs only on open roads and designated trails.
- Has moderate emphasis on dormant season prescribed burning.

Alternative A would continue with current management and the continuation of the Land and Resource Management Plan for the Ozark-St. Francis National Forests, as amended. This Forest Plan was signed in July 1986 and has been amended 13 times.

This alternative reflects how the Current Plan is being implemented as a result of policy changes, budgets, and personnel. Management activities were designed to improve the age class distribution in all forest types and provide a balanced market and non-market resource program to maintain a broad geographic distribution of socio-economic benefits. A good distribution of age classes was proposed while maintaining a vigorous forest condition that produced increases in high-quality sawtimber and other timber products.

This alternative provides opportunities for developed and dispersed recreation experiences. Wilderness areas in 1986 included East Fork, Hurricane Creek, Leatherwood, Richland Creek, and the Upper Buffalo. Wild and Scenic Rivers included Big Piney Creek, Buffalo River, Hurricane Creek, Mulberry River, North Sylamore Creek, and Richland Creek This alternative provides for the maintenance of an optimum population of game and non-game species and protection of sensitive species.

Soil productivity is maintained and improved on disturbed areas. Proposals for mineral exploration and development are responded to in coordination with other resource values. Emphasis is given to energy related minerals. The Lands Program is managed to support multiple resources. A transportation system is provided to meet all resource needs. Protection measures needed to protect public and resource values are emphasized.

Prescribed burning is utilized as a vegetation management tool to accomplish resource management objectives and for fuel treatments to reduce the risk from wildland fire to natural resources, life, or private property. Wildland fires are managed utilizing the full array of appropriate management responses proportionate to resource values at risk, firefighter safety, public safety, and the protection of private property.

Alternative B - Emphasizes Production of Goods and Services

- Emphasizes providing goods and services to local economies and communities.
- Emphasizes high-use, low-cost recreational activities supporting tourism.
- Emphasizes providing high quality scenery.
- Adds additional scenic byways across the Forests.
- Emphasizes Lake Wedington as an Urban Recreation Forest.
- Recommends North Fork of the Illinois Bayou as a Wild and Scenic River.
- Manages wildlife for public demand game and non-game species.
- Adds a high quality wildlife area.
- Increases watershed restoration to improve fisheries for recreational and beneficial use values.
- Manages timber for sustained yield of high-value forest products on highly productive lands.
- Provides old growth on unsuitable lands.
- Emphasizes providing access to Forests to enhance recreation opportunities beneficial to tourism.
- Generally, reduces the amount of long-term permanent access because of a large area of custodial management. In the short term, access may increase as needed to achieve management goals.
- Emphasizes energy exploration, development, and production (oil and gas leases).

Alternative B concentrates on opportunities that provide good economic returns while benefiting local communities. Timber management would provide a sustained yield of wood products emphasizing high quality sawtimber from high-site land and providing

high economic returns. Vegetation would be actively managed to reduce risk and threats associated with forest pests especially in areas related to tourism or high-value timber.

Developed and dispersed recreation opportunities and high-quality scenery would be provided in a variety of settings that benefit tourism. This alternative shifts from traditional recreation opportunities toward increasing day-use, sightseeing, and trail opportunities. Developed recreation focuses on high-use, high-value sites providing the greatest tourism benefits. Public access (travel-ways, use corridors, trails) would be maintained in high-use, low-cost areas.

Alternative C – Ecological Restoration Emphasis

- Emphasizes biologically driven restoration of ecosystems at the landscape level.
- Adds pine and oak woodland emphasis areas.
- Mimics natural process in a natural landscape pattern.
- Emphasizes controlling non-native invasive species.
- Emphasizes management of rare, unique, and sensitive species.
- Emphasizes restoring fire-dependent and fire-influenced ecosystems.
- Emphasizes wood products as the by-product of ecosystem management.
- Adds the Upper Buffalo and Indian Creek Dispersed Recreation Areas
- Recommends 471 acres of adjacent land for wilderness additions.
- Recommends North Fork of the Illinois Bayou as a Wild and Scenic River.
- Adds additional Special Interest Areas.
- Adds adjacent acquired land next to existing wildernesses.
- Emphasizes providing a wide variety of recreational activities.
- Generally, reduces the amount of long-term permanent access. In the short-term, access may increase as needed to achieve management goals.

Alternative C is biologically driven with an emphasis on restoration of vegetation to a reference condition (pre-settlement) based on the ecological potential and capability of the land. When possible, natural processes are mimicked in a landscape pattern. Restoration activities would produce both large and small openings. Timber production results from management to restore and maintain natural processes, communities, and wildlife habitats. Timber sales would facilitate resource goals.

Numerous large and medium sized blocks of old growth are provided on both suitable and unsuitable lands; small blocks occur scattered throughout the Forests. Integrated pest management would be implemented to reduce forest health risks.

In some areas of the Forests, scenic resources move gradually toward high-to-very high scenic integrity. Restoration of areas results in short-term, low-to-moderate scenic integrity but with a long-term goal of high scenic integrity. A wide variety of recreation opportunities are provided. Developed and dispersed recreation show increases, especially activities in support of restoration and ecosystem management.

Terrestrial, riparian, and aquatic ecosystems would be maintained and restored. In some areas of the Forests, scenic resources would move gradually toward high to very high scenic integrity. A variety of recreation settings would occur in areas compatible with restoration. Integrated pest management would be used to lower forest health risks. Non-native species such as gypsy moth and kudzu would be controlled. Any restoration needs would be made compatible with wild and scenic river classification and its outstandingly remarkable values. Access would be provided as needed to restore and protect aquatic systems, soils, and plant and animal communities.

Alternative D – Balanced Forest Age Class Emphasis

- Emphasizes balancing pine and hardwood type age classes.
- Attains approximately equal acres in each age class.
- Makes all suitable lands available for sustained yield management.
- Provides the majority of old growth on unsuitable lands.
- Controls and prevents insect and disease risk are on suitable lands using a variety of silvicultural practices.
- Emphasizes prescribed burning to accomplish fuels reduction, silvicultural and wildlife habitat improvements.
- Provides a variety of developed and dispersed recreation activities.
- Manages for consumptive and non-consumptive wildlife species.
- Generally, slightly increases the amount of long-term permanent access. Access would be developed, maintained, and used to meet the goal of balanced age classes, wildlife habitat, and production of timber products.

The emphasis of Alternative D would be to reach and maintain balanced age classes on pine and hardwood forest types. All suitable lands would be available for sustained yield management. On suitable lands, each of the major forest groups would have a specific target "rotation age" or age at which it would be harvested and replanted with the same forest group. Insects, diseases, and exotic plant and animal species on suitable lands are actively controlled and prevented.

Large and medium sized blocks of old growth are provided on both suitable and unsuitable lands for timber production. Small blocks occur scattered throughout the Forests. Integrated pest management would be implemented to reduce forest health risks.

Access would be developed, maintained, and used as needed to meet the goal of balanced age classes, wildlife habitats, and production of timber products. Developed and dispersed recreation opportunities are provided in a variety of settings that are both natural and managed. Riparian areas are managed to retain, restore, and/or enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within riparian corridors.

Alternative E – Balanced Age Class/Restoration Mix (Preferred Alternative)

- Combines management strategies (balance age classes and ecosystem restoration).
- Focuses dispersed recreation on high-use, low-cost activities.
- Shifts recreation toward day-use, sightseeing, and trail opportunities.
- Adds the Upper Buffalo and Indian Creek Dispersed Recreation Areas.
- Adds additional Special Interest Areas.
- Recommends 471 acres of adjacent land for wilderness additions.
- Recommends North Fork of the Illinois Bayou as a Wild and Scenic River.
- Adds additional scenic byways across the Forests.
- Emphasizes producing high-quality wood products.
- Emphasizes maintaining habitat for diversity of species.
- Emphasizes rare, unique, and sensitive species habitats.
- Emphasizes controlling invasive non-native species.
- Moderately emphasizes old growth (suitable and unsuitable lands).
- Emphasizes prescribed burning for ecosystem restoration, silvicultural reasons, wildlife habitat, and fuels reduction.
- Emphasizes closing open roads (primarily gates and mounds) or using seasonal road closures.
- Generally, decreases the amount of long-term permanent access.

Alternative E recognizes and balances the wide diversity of interests and values in management of the Forests using a mix of vegetation management practices to manage forest ecosystems. It emphasizes water quality, a variety of recreation opportunities, sustainable forest ecosystem management on lands suitable for timber production, habitat for the full spectrum of species, and a quality forest transportation network. Some ecosystems are restored to pre-settlement conditions based on the ecological potential and capability of the land. When possible, natural processes are mimicked in a landscape pattern. Restoration activities would produce both large and small openings.

High quality developed and dispersed recreation opportunities occur emphasizing the Forests' role in providing outdoor recreation. Semi-primitive recreation opportunities, SIAs, outstandingly remarkable river values, and high scenic areas (including scenic views) are provided.

Large and medium sized blocks of old growth are provided on both suitable and unsuitable lands. Small blocks occur scattered throughout the forests. Integrated pest management would be implemented to reduce forest health risks.

Access would be developed, maintained, and used as needed to meet the goal of balanced age classes, restoration, wildlife habitats, and production of timber products.

COMPARISON OF ALTERNATIVES

This section compares the management alternatives from several different perspectives. The acreage allocated to each management area 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 Area Acres by Alternative

Table 2-1 provides a description of the management areas (MAs).

Table 2-1: Management Areas.

Management Areas	Management Area Names
0.A	Custodial Management
1.A	Designated Wilderness
1.B	Recommended Wilderness Additions
1.C	Designated Wild and Scenic Rivers
1.D	Recommended Wild and Scenic Rivers
1.E	Experimental Forests
1.F	Research Natural Areas
1.G	Special Interest Areas
1.H	Scenic Byway Corridors
2.A	Ozark Highlands Trail
2.B	State Parks
2.C	Developed Recreation Areas
2.D	Upper Buffalo Dispersed Recreation Area
2.E	Wedington Unit Urban Recreation Area
2.F	Indian Creek Dispersed Recreation Area
3.A	Pine Woodland
3.B	Oak Woodland
3.C	Mixed Forest
3.D	Oak Decline Restoration Areas
3.E	High Quality Forest Products
3.F	Old Growth Area
3.G	Crowley's Ridge Upland Hardwood, St. Francis NF
3.H	Mississippi River Bottomland Hardwood, St. Francis NF
3.I	Riparian Corridors
3.J	Pastures and Large Wildlife Openings
3.K	Wildlife Emphasis Area
3.L	Urban/Suburban Interface

Table 2-2 shows the acres on the OSFNFs that would be allocated to each management area for each alternative.

Table 2-2: Management Area Acres by Alternative.

Management Prescription	Acres by Alternative				
	A	B	C	D	E
0.A	0	518,791	0	0	0
1.A	66,223	66,223	66,223	66,223	66,223
1.B	0	0	471	0	471
1.C	19,859	19,859	19,859	19,859	19,859
1.D	0	6,219	6,219	0	6,219
1.E	5,071	5,071	5,071	5,071	5,071
1.F	2,682	2,682	2,682	2,682	2,682
1.G	22,311	22,311	23,243	22,311	23,243
1.H	27,456	41,344	27,456	27,456	41,344
2.A	6,176	6,176	6,176	6,176	6,176
2.B	3,806	3,806	3,806	3,806	3,806
2.C	3,110	3,110	3,110	3,110	3,110
2.D	0	0	6,115	0	6,115
2.E	0	10,467	0	0	10,467
2.F	0	0	17,844	0	17,100
3.A	22,570	0	98,196	0	97,629
3.B	30,858	0	168,926	0	154,704
3.C	945,453	0	598,422	0	360,401
3.D	0	67,691	68,521	77,311	67,691
3.E	0	354,632	0	905,025	214,358
3.F	0	0	5,062	5,062	5,062
3.G	0	0	11,443	0	11,443
3.H	0	0	3,573	0	3,573
3.I	0	11,484	11,484	11,484	11,484
3.J	7,072	7,072	7,072	7,072	7,072
3.K	0	15,712	0	0	15,712
3.L	0	5,280*	0	5,280*	0
Total	1,160,278	1,160,278	1,160,278	1,160,278	1,160,278

Note: Acres are estimates only based on GIS. Some acres overlap because of priorities assigned when creating the management area layer.
***Acres in MA 3.L are for display purposes only, and not included in total acreages.**

Issue 1–Mix of Recreation Opportunities

The OSFNFs provide a wide variety of recreational opportunities including traditional recreation uses such as camping, hiking, horseback riding, swimming, hunting, fishing, and driving for pleasure. Other increasingly popular uses include mountain biking, rock climbing, shooting ranges, and whitewater activities.

Recreational opportunities can be classified as either dispersed or developed recreation. Dispersed recreation includes all the outdoor recreation activities that occur on the Forests outside of developed sites such as hiking, horseback riding, mountain biking, hunting, and fishing. Developed recreation includes distinctly defined areas where facilities are provided for concentrated public use such as campgrounds and picnic areas.

The analyzed alternatives have the potential to affect dispersed recreational settings more than developed sites. More users and recreation interests have expressed concern about the management of dispersed recreation than developed recreation. Approximately 42 percent of the current recreation visits are considered developed and about 58 percent can be defined as dispersed recreation. This gap is expected to widen over the next few decades. The challenge is to capitalize on the OSFNFs' unique qualities and shift toward dispersed recreation while minimizing user conflicts and providing for other forest uses and products demanded by other segments of the public.

One facet of this issue is the compatibility of uses. Some conflicts have arisen on multi-use trails, which currently allow an array of activities (such as OHV use, hiking, horse riding, and other trail uses) to share the same trail. There is a strong interest in increasing both the miles of single-use trails and the total trail networks for all uses.

Some recreation users would like more dispersed areas that provide semi-primitive motorized experiences, or at least an alternative to wilderness. These areas would provide more opportunities for solitude, isolation, quiet, and a backcountry experience.

Another facet of this issue includes access and proximity of dispersed recreation opportunities to population centers and points of entry on the Forests. The northwest portion of the state is expected to see a 40 to 50 percent population growth in the next 10 to 20 years. This could dramatically affect visitor use on the western half of the Ozark National Forest. One state park is under construction on national forest lands, and another is in the planning stages (Mississippi State Park on the St. Francis NF and Mount Magazine State Park on the Ozark NF). When operational, visitor use on forestlands near these state parks could increase. The challenge is how to balance the dispersed recreation needs across the forests.

Table 2-3 shows a comparison of the mix of recreation opportunities, and how the alternatives differ in providing for projected visits in dispersed versus developed recreation activities.

Table 2-3: Issue 1-Mix of Recreation Activity Opportunities Compared by Alternative.

Recreation Opportunities	Alternatives				
	A	B	C	D	E
Developed Recreation	**Unit of Comparison – Visitor Use**				
Developed Camping	Low	Mod	Low	Low	Mod
Resorts, Cabins	Low	Low	Low	Low	Low
Visiting Historical Sites	Low	Low	Low	Low	Low
Visiting Nature Centers	Low	Low	Low	Low	Low
Dispersed Recreation	**Unit of Comparison – Visitor Use**				
Backpacking	Low	Low	Low	Low	Low
Wilderness	Low	Low	Mod	Low	Mod
Viewing Wildlife, Birds, Fish	Low	Mod	Mod	Low	Mod
Nature Study	Low	Mod	Mod	Low	Mod
Hiking/Walking	Low	Low	Mod	Low	Mod
Viewing Scenery	Low	Mod	Mod	Low	Mod
Driving for Pleasure	Low	Mod	Low	Low	Mod
Mountain Biking	Low	Low	Mod	Low	Mod
Picnicking	Low	Low	Low	Low	Low
Swimming	Low	Low	Low	Low	Low
Off-Highway Vehicles (OHVs)	Low	Mod	Low	Low	Mod
Horseback Riding	Low	Mod	Mod	Low	Mod
Fishing	Low	Low	Low	Low	Low
Canoeing, Kayaking, Rafting	Low	Low	Low	Low	Low
Primitive Camping	Low	Low	Low	Low	Low
Hunting	Low	Low	Low	Low	Low

Low = < 5% increase in existing PAOTs (persons-at-one-time). Mod = 6-25% increase in existing PAOTs. High = > 26% increase in existing PAOTs. Decrease = any net loss of existing PAOTs

The developed recreation issue focuses on the number, type, and amenities provided. Because of their age and heavy use, many of the Forests' recreational facilities are deteriorating. Lack of funds to maintain and repair them may necessitate closing some areas and limiting designation of new ones. Effective resolution of this issue is a goal of the Revised Forest Plan. Table 2-4 compares the ability of each alternative to provide developed recreation capacity.

Table 2-4: Issue 1-Mix of Recreation Opportunities-Developed Recreation.

Developed Recreation	Alternatives				
	A	B	C	D	E
	Unit of Comparison-Increase in Capacity PAOTs				
Day-Use Areas	Low	Mod	Mod	Low	Mod
Level 2 Campground	Decrease	Decrease	Decrease	Decrease	Decrease
Level 3 Campground	Low	Low	Low	Low	Low
Level 4 Campground	Low	Mod	Low	Low	Low
Level 5 Campground	Low	Mod	Low	Low	Mod

Low = < 5% increase in existing PAOTs (persons-at-one-time). Mod = 6-25% increase in existing PAOTs. High = > 26% increase in existing PAOTs. Decrease = any net loss of existing PAOTs

The dispersed recreation issue focuses on a wide range of activities the Forests can provide that are considered dispersed. Many of these activities do not require heavy funding, but are opportunities that can be emphasized and provided through other resource activities such as vegetation management. Table 2-5 compares the ability of each alternative to provide dispersed recreation. The recreation opportunity spectrum (ROS) is used to show how different alternatives provide different recreation settings ranging from primitive in wilderness to an urban setting at highly developed campgrounds.

Table 2-5: Issue 1-Mix of Recreation Opportunities-Dispersed Recreation.

Dispersed Recreation	Alternatives				
	A	B	C	D	E
Recreation Settings	**Unit of Comparison-Acres**				
Primitive	68,062	68,062	68,534	68,062	68,534
Semi-primitive non-motorized	6,176	6,176	6,176	6,176	6,176
Semi-primitive motorized	2,682	527,692	13,963	7,744	13,963
Semi-primitive motorized to semi-primitive non-motorized	0	0	23,960	0	23,215
Semi-primitive motorized to roaded natural	38,512	54,223	41,115	38,512	56,828
Roaded Natural	1,054,377	503,190	1,016,061	1,049,315	990,626
Roaded Natural to Urban	0	10,467	0	0	10,467
Non-Motorized Trails	**Unit of Comparison-Increase or Decrease**				
Hiking	Low	Mod	Mod	Low	Mod
Horseback	Low	Mod	Mod	Low	Mod
Bike	Low	Low	Low	Low	Low
Whitewater	Low	Low	Low	Low	Low
Multiple Use Trails	**Unit of Increase or Decrease**				
	Low	Mod	Low	Low	Mod
Hunting	**Unit of Comparison-Acres 0-10 Age Class Decade 1**				
Early Successional Habitat	102,478	102,542	62,952	110,000	80,000
Hunting	**Unit of Comparison-Acres 0-10 Age Class Decade 5**				
Early Successional Habitat	45,583	41,509	55,133	58,032	51,366

Table 2-5: Issue 1-Mix of Recreation Opportunities-Dispersed Recreation. (Continued)

Dispersed Recreation	Alternatives				
	A	B	C	D	E
Fishing	**Unit of Comparison- Increase or Decrease**				
Coldwater	Low	Mod	Low	Low	Mod
Warmwater	Low	Low	Low	Low	Low
Viewing Scenery or Wildlife	**Unit of Comparison- Increase or Decrease**				
	Low	Mod	Mod	Low	Mod
Driving for Pleasure	**Unit of Comparison- Increase or Decrease**				
	Low	Mod	Low	Low	Mod

Low = < 5% increase of existing miles of non-motorized trail (0 to 15 miles)
Mod = 6-25% increase of existing miles of non-motorized trail (16 to 75 miles)
High = > 26% increase of existing miles of non-motorized trail (over 75 miles)
Decrease = any net loss of existing trail

Issue 2–Public Access

Forest Service roads are the primary means of national forest access; however, they are also a source of many concerns. Currently there are over 5,900 miles of Forest Service roads on the OSFNFs. Some people would like to see the majority of the Forests accessible by roads to maximize opportunities for hunting, driving for pleasure, and resource management. Other people are concerned that the Forests have too many roads, the road density is currently too high, and that some existing roads should be closed (gates or mounds) or obliterated. Other comments were made that new roads should not be constructed for the purposes of logging. 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 scope of this issue also includes motorized use of off-highway-vehicles (OHVs) on forest roads and trails. The current Forest Plan permits OHV use only on designated roads and trails. There are currently four multiple-use trails (Mill Creek, Brock Creek, Moccasin Gap, and Devils Den) on the Ozark NF totaling 156 miles that allow OHV use. OHV use is currently prohibited on the Lake Wedington Unit of the Ozark National Forest and the entire St. Francis National Forest. One of the proposals in the DEIS was to manage the Indian Creek Dispersed Recreation Area (MA 2.F in the Revised Forest Plan) as non-motorized. This proposal turned out to be highly controversial. Changes have been made to provide motorized access to dispersed recreation opportunities, and to work with interested users when designating roads and trails in that area.

The current OHV policy received much public attention. Closing areas to motorized use affects access that many perceive as reducing recreational opportunities. Some publics want areas to be managed for non-motorized uses to increase opportunities for solitude. Forest Service concerns include lack of budgets to maintain the current trail systems, impacts to the soil and water resources, and impacts to wildlife populations and habitat. The alternatives include combinations of land allocation for motorized and

non-motorized trail opportunities and road access to minimize conflict among users, provide recreation opportunities, and protect the resources.

Table 2-6 displays estimated trends for the road system on the OSFNFs by alternative. Increases in roads constructed or reconstructed are estimated to be very low (Table 3-194). The Forests' program of decommissioning and closing roads using gates is expected to continue and will result in a net decrease in road miles over the next few decades in Alternatives B, C, and E (preferred alternative).

Table 2-6: Issue 2-Public Access/Road System.

Public Access Road System	Alternatives				
	A Current Miles	B	C	D	E
Roads Within Forests' Boundaries	**Unit of Comparison-Trends in Amount of Roads**				
Federal	NC	NC	NC	NC	NC
State	NC	NC	NC	NC	NC
County	NC	NC	NC	NC	NC
Forest Service					
Maintenance Level 5	NC	NC	NC	NC	NC
Maintenance Level 4	NC	NC	NC	NC	NC
Maintenance Level 3	NC	NC	NC	NC	NC
Maintenance Level 2	NC	—	—	NC	—
Maintenance Level 1	NC	—	—	NC	—
Roads Closed to Public Travel	**Unit of Comparison-Trends**				
Forest Service	NC	+	+	NC	+
Estimated Road New Construction	**Unit of Comparison-Trends**				
1st Decade	+	+	+	+	+
5th Decade	+	+	+	+	+
Estimated Road Re-Construction	**Unit of Comparison-Trends**				
1st Decade	+	+	+	+	+
5th Decade	+	+	+	+	+
Estimated Roads Decommissioned	**Unit of Comparison-Trends**				
1st Decade	NC	+	+	NC	+
5th Decade	NC	+	+	NC	+
Estimated Level 2 Roads-Gated or Mounded	**Unit of Comparison-Increase/Decrease**				
	NC	NC	+	NC	+

NC = No Change
+ = Increase
— = Decrease

Table 2-7: Issue 2-Public Access/OHVs.

Public Access Off-Highway Vehicles	Alternatives				
	A	B	C	D	E
Types of Access	**Unit of Comparison-Miles/Trends**				
Use of Level 1 & Level 2 Roads for OHV Trails	NC	NC	+	NC	+

NC = No Change
+ = Increase

Issue 3–Special Areas

The OSFNFs consider special areas to include special interest areas, roadless areas, wild and scenic rivers, wildernesses, research natural areas, scenic byways, and experimental forests. Wild and scenic rivers, wilderness, research natural areas (RNAs), special interest areas (SIAs), and experimental forests were given special designation in the current Plan.

Roadless Areas and Wilderness Management

Forest Service policy and regulations in 36 CFR 219.17 require that roadless areas be evaluated and considered for recommendation as potential wilderness areas during the forest planning process. The OSFNFs currently have five wilderness areas. Management Area 1 of the 1986 Forest Plan provides direction for these areas. These wilderness areas were originally identified in the Roadless Area Review and Evaluation, known as RARE II. There are approximately 73,000 acres left from RARE II not designated as wilderness. These areas were allocated to other management areas in the 1986 plan. These lands were also identified in a set of inventoried roadless area maps contained in the Forest Service Roadless Area Conservation, FEIS, Volume 2, dated November 2000. Forest Service Interim Direction 1920-2001-1 dated December 14, 2001, stated lands remaining from the RARE II inventory would be re-evaluated for roadless area characteristics during the forest plan revision process. The Forests re-evaluated these lands as well as any other lands to determine if they meet roadless area inventory criteria. The re-inventory shows that there are no areas on the Forests that meet these criteria (Appendix C). There are, however, areas that have been acquired adjacent to existing wilderness that will be considered for wilderness addition in Alternatives C and E. These lands are being considered for other allocations in the remaining alternatives. Table 2-8 displays the differences in alternatives for proposed wilderness additions and the RARE II areas.

Table 2-8: Issue 3-Wilderness Additions.

Roadless Areas Wilderness Additions	Alternatives				
	A	B	C	D	E
	Unit of Comparison-Acres				
Proposed Wilderness Additions			471		471

Special Interest Areas

The 1986 Land Resource Management Plan identified approximately 23,100 acres as SIAs. These were areas with unique scenic, geological, botanical, or cultural values. Amendment 5 to the Plan provided management direction for approximately 50,000 acres in Management Area 8 to be evaluated for SIA additions or expansion. This amendment was the result of a settlement agreement from an appeal to the Plan. The amendment deferred or limited timber sales during the remaining planning period, and developed a process to determine what was unique about the areas; set possible boundaries; and determine whether the areas would remain SIAs, or be returned to other management area designation. The OSFNFs developed a set of criteria to determine if the areas mentioned in Amendment 5 or any other areas on the Forests had special, unique qualities to be considered SIAs, Using that criteria, it was determined that Eagle Gap, and an addition to Pedestal Rocks met the criteria. The remaining areas, along with other possible areas on the Forests, were evaluated to determine if they have any unique qualities that warrant special area designation. Three new SIAs were found using those criteria. Amendment 6 to the Plan designated Dismal Hollow as a research natural area, therefore, removing it from the original list of SIAs. Table 2-9 displays the existing and proposed SIA acres.

Table 2-9: Issue 3-Special Interest Areas.

Special Interest Areas	Alternatives				
	A	B	C	D	E
Existing Special Interest Areas	**Unit of Comparison-Acres**				
	22,311	22,311		22,311	
Special Interest Areas Including New SIAs and Boundary Adjustments	**Unit of Comparison-Acres**				
			23,243		23,243

Experimental Forests

The purpose of an experimental forest is to test innovative new management techniques or technologies that go beyond the current standards, guidelines, or decisions. There are currently two experimental forests on the OSFNFs; Henry R. Koen and Sylamore. The Southern Research Station manages both of these areas. Public comments did not identify any need to change current direction. Table 2-10 shows the experimental forest allocations by alternative.

Table 2-10: Issue 3-Experimental Forests.

Experimental Forests	Alternatives				
	A	B	C	D	E
Existing	**Unit of Comparison-Acres**				
Henry R. Koen	700	700	700	700	700
Sylamore	4,200	4,200	4,200	4,200	4,200
Total	4,900	4,900	4,900	4,900	4,900

Research Natural Areas

Research natural areas (RNAs) provide a spectrum of relatively undisturbed areas representing important natural ecosystems and environments. The goal of RNAs is to provide undisturbed forest, shrub, and aquatic ecosystems for non-manipulative research, observation, and study. There are currently two RNAs on the OSFNFs: Turkey Ridge and Dismal Hollow (designated in Amendment 6 - May 1990). The public did not identify any need to change current direction. The Table 2-11 shows the RNA allocations by alternative.

Table 2-11: Issue 3-Research Natural Areas.

Research Natural Areas	Alternatives				
	A	B	C	D	E
Existing	Unit of Comparison-Acres				
Turkey Ridge	400	400	400	400	400
Dismal Hollow	2,077	2,077	2,077	2,077	2,077
Total	2,477	2,477	2,477	2,477	2,477

Scenic Byways

The OSFNFs have six scenic byways. Each of these has unique characteristics. Scenic byways add to the tourism values of the area, with driving for pleasure still being one of the uses in greatest demand. Corridor management objectives need to be defined, including such things as turnout lanes, vistas, and vegetation management guidelines. Some of the alternatives provide for additional scenic byways. The revision will need to provide direction that will protect and enhance the qualities of the scenic byways and determine if other byways should be nominated. Additional scenic byways are added in some alternatives, Table 2-12.

Table 2-12: Issue 3-Scenic Byways.

Scenic Byways	Alternatives				
	A	B	C	D	E
Existing Scenic Byways	Unit of Comparison-Miles				
Miles of Byway	165	165	165	165	165
Additional Scenic Byways	Unit of Comparison- Miles				
Forest Service		74			74
Total Forest Miles	165	239	165	165	239

Wild and Scenic Rivers

The OSFNFs currently have six Wild and Scenic Rivers: Big Piney Creek, Buffalo River, Hurricane Creek, Mulberry River, North Sylamore Creek, and Richland Creek. The designation of wild and scenic rivers is a multi-stage 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. The Department of Interior, National Park Service completed a Nationwide River Inventory in 1979. That study identified 13 rivers as eligible for further study to determine suitability of a river to be recommended as wild and scenic. In 1990, the OSFNFs completed a study of the thirteen rivers, and concluded six were suitable to be recommended for designation. In 1992, Congress designated the existing six wild and scenic rivers on the Forests. A re-evaluation of that study was conducted during plan revision to see if the suitability recommendations have changed. Based on that review, the Forests are recommending in Alternatives B, C, and E that the North Fork of the Illinois Bayou be designated as part of the wild and scenic rivers system.

When eligible rivers are analyzed for their suitability in the Revised LRMP, the determination of whether or not to recommend an eligible river for designation would vary based on the overall management emphasis of the LRMP 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 wild and scenic rivers, methods of protecting or enhancing the rivers' ORVs will vary according to their classification.

Rivers that are not recommended for national designation will still be managed to protect their outstanding values. The rivers that are eligible, but determined to be "not suitable" will be managed in a variety of ways ranging from preservation to restoration to simply following Arkansas' BMPs 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. They would be managed to protect their outstandingly remarkable values. Table 2-13 shows the current as well as proposed wild and scenic rivers on the OSFNFs.

Table 2-13: Issue 3-Wild and Scenic Rivers.

Wild and Scenic Rivers	Alternatives				
	A	B	C	D	E
Currently Designated	**Unit of Comparison-Miles**				
Big Piney Creek	45.2	45.2	45.2	45.2	45.2
Buffalo River	15.8	15.8	15.8	15.8	15.8
Hurricane Creek	15.5	15.5	15.5	15.5	15.5
Mulberry River	56.0	56.0	56.0	56.0	56.0
North Sylamore Creek	14.5	14.5	14.5	14.5	14.5
Richland Creek	16.5	16.5	16.5	16.5	16.5
Rivers Recommended	**Unit of Comparison-Miles**				
North Fork of Illinois Bayou	0	22.6	22.6	0	22.6
Total Forest Wild and Scenic River Miles	163.5	186.1	186.1	165	186.1

Issue 4–Ecosystem Health and Sustainability

When the Land and Resource Management Plan (LRMP) was approved in 1986, the Forest Service's management philosophy, known as ecosystem management, was a new concept and not the focus of the time. Little, if any, guidance existed to understand how ecosystems work and how human activities affect them over time. The 1986 LRMP focused on single resources such as timber, wildlife habitat, biodiversity, or recreation. It tended to focus on the "parts," not the "whole" of an ecosystem.

Ecosystem management is a concept of natural resources management wherein NF activities are considered within the context of economic, ecological, and social interactions within a defined area or region over both short and long term. Ecosystem management is a shift in focus from managing outputs of ecosystems to maintaining the structure and function of ecosystems through time and for the benefit of present and future generations.

The direction in the 1986 LRMP is insufficient for today's concerns about landscape ecology, biological diversity, fire ecology, restoring ecosystems, historic range of variability, and mimicking natural disturbance patterns. One of the lessons researchers and forest managers have learned is that when a forest has a full genetic deck, it is resilient enough to bounce back from environmental stress. It is also better equipped to deliver goods and services that humans need.

The OSFNFs decided to evaluate how the alternatives address this issue by using the five criteria outlined below.

- A Conservation of biological diversity.
- B Maintenance of the productive capacity of forest ecosystems.
- C Maintenance of the forest ecosystem health and vitality.
- D Conservation and maintenance of soil and water resources.
- E Maintenance and enhancement of long term socio-economic benefits to meet the needs of society.

A - Conservation of Biological Diversity—maintaining a variety of habitats for terrestrial and aquatic flora and fauna. The ultimate objective of the conservation of biological diversity is the survival of species and the genetic variability within those species. Viable breeding populations of species and their natural genetic variation are part of interdependent physical and biological systems (processes) or communities (ecosystems). The condition and distribution of forest communities are important to fundamental ecological processes and systems and the future of biological diversity associated with forests. Table 2-14 shows comparisons of how the alternatives affect terrestrial and aquatic species viability, the effects on rare and special communities, and how certain selected Management Indicator Species (MIS) are affected by the alternatives.

Table 2–14: Issue 4-Ecosystem Health and Sustainability/Biological Diversity for Selected Management Indicator Species (MIS).

Ecosystem Health/Sustainability Biological Diversity	Alternatives				
	A	B	C	D	E
MIS Species Trends	**Unit of Comparison-Percent Increase or Decrease over Current Management in Decade 1**				
Whitetail Deer	5%	2%	8%	12%	4%
Bobwhite Quail	14%	5%	23%	32%	14%
Wild Turkey	2%	1%	3%	8%	6%
Prairie Warbler	62%	27%	73%	73%	62%
Yellow-Breasted Chat	25%	0%	17%	22%	6%
Pileated Woodpecker	-3.1%	-2.2%	-5.1%	+1.4%	-4.5%
Scarlet Tanager	-1.6%	-1.3%	-2.3%	+3.2%	-2.3%
Northern Parula	19%	18%	35%	25%	15%
Ovenbird	2%	6%	4%	3%	4%
MIS Species Trends	**Unit of Comparison-Trend, Increase or Decrease Decade 1**				
Smallmouth Bass	+	+	+	+	+
Largemouth Bass	+	+	+	+	+

+ = Increase

Another method to evaluate how biological diversity compares by alternative is to look at the total numbers of factors key to sustaining ecological systems or "communities." The assumption is that resulting conditions will provide for viability of the great majority of existing species. Table 2-15 represents summaries of key factor indicators for each alternative compared to the current situation (see Chapter 3 FEIS, "Major Forest Communities" section for the complete effects analysis).

Table 2-15: Comparison of Total Numbers of Key Factor Indicators by Condition for Major Forest Communities.

Condition of Key Factors	Current	Alternatives				
		A	B	C	D	E
Condition	**Dry Oak Forest and Woodland Decade 1**					
Very Good	1	1	1	3	1	1
Good	0	0	0	0	0	2
Fair	1	3	2	1	3	1
Poor	7	5	6	5	5	5
Condition	**Dry Oak Forest and Woodland Decade 5**					
Very Good	1	2	2	4	2	2
Good	0	0	0	0	2	2
Fair	1	4	4	3	2	3
Poor	7	3	3	2	3	2
Condition	**Shortleaf Pine Oak-Forest and Woodland Decade 1**					
Very Good	2	2	2	4	3	2
Good	1	1	0	0	0	2
Fair	1	2	3	1	2	1
Poor	4	3	3	3	3	3

Table 2-15: Comparison of Total Numbers of Key Indicators by Condition. (Continued)

Condition of Key Factors	Current	Alternatives				
		A	B	C	D	E
Condition	**Shortleaf Pine Oak-Forest and Woodland Decade 5**					
Very Good	2	3	2	4	4	3
Good	1	2	2	2	0	3
Fair	1	2	3	2	2	2
Poor	4	1	1	0	2	0
Condition	**Dry-Mesic Oak Forest Decade 1**					
Very Good	1	1	1	3	1	1
Good	0	0	0	0	1	2
Fair	1	3	2	1	2	1
Poor	6	4	5	4	4	4
Condition	**Dry-Mesic Oak Forest Decade 5**					
Very Good	1	2	2	4	2	2
Good	0	1	0	1	2	2
Fair	1	3	4	1	2	2
Poor	6	2	2	2	2	2
Condition	**Loess Slope St. Francis NF Decade 1**					
Very Good	1	1	1	3	1	1
Good	0	1	0	1	1	3
Fair	2	3	4	1	3	1
Poor	5	3	3	3	3	3
Condition	**Loess Slope St. Francis NF Decade 5**					
Very Good	1	3	2	5	3	2
Good	0	0	0	0	1	4
Fair	2	2	3	0	2	0
Poor	5	2	2	2	2	2
Condition	**Bottomland and Floodplain St. Francis NF Decade 1**					
Very Good	2	3	3	3	3	3
Good	0	1	1	0	0	0
Fair	0	0	0	0	0	0
Poor	2	0	0	1	1	1
Condition	**Bottomland and Floodplain St. Francis NF Decade 5**					
Very Good	2	4	4	2	2	2
Good	0	0	0	0	0	0
Fair	0	0	0	0	0	0
Poor	2	0	0	2	2	2
Total Abundance	**Loblolly Pine Forests Decade 1**					
Total Acres on Ozark NF	13,229 Poor	13,229 Poor	13,229 Poor	13,229 Poor	13,229 Poor	13,229 Poor
Total Acres on St. Francis NF	137 Poor	137 Poor	137 Poor	137 Poor	137 Poor	137 Poor
Total Abundance	**Loblolly Pine Forests Decade 5**					
Total Acres on Ozark NF	13,229 Poor	8,838 Fair	8,838 Fair	8,838 Fair	8,838 Fair	8,838 Fair
Total Acres on St. Francis NF	137 Poor	0 V. Good	0 V. Good	0 V. Good	0 V. Good	0 V. Good

One other method to evaluate how biological diversity compares by alternative is to focus on species that are most at risk of losing viability and their habitat needs. Summaries are in Table 2-16 (see Chapter 3 of the FEIS for the complete effects analysis).

Table 2-16: Comparison of Habitat Conditions for Species Groups Decades 1 and 5

Condition	Current	Alternatives				
		A	B	C	D	E
		Conditions after Decade 1				
Very Good	6	9	9	9	9	9
Good	5	3	3	3	3	3
Fair	4	4	4	4	4	5
Poor	7	6	6	6	6	5
		Conditions after Decade 5				
Very Good	6	12	11	10	11	12
Good	5	4	4	6	4	5
Fair	4	3	4	3	3	3
Poor	7	3	3	3	4	2

Tables 2-17 and 2-18 display a comparison of rare and special communities in Decade 1 and Decade 5 that typically occupy a small proportion of the landscape, but contribute significantly to plant and animal diversity. This is another measure of forest health.

Table 2-17: Comparison of Ratings for Rare and Special Communities Decade 1.

Indicators	Current	Alternatives				
		A	B	C	D	E
Glades and Barrens at Desired Conditions	Poor	Fair	Fair	Fair	Fair	Fair
Montane Oak Forest at Desired Conditions	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Cliff and Talus at Desired Conditions	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Sinkholes, Depressions and Ponds at Desired Conditions	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Seeps and Fens at Desired Conditions	Fair	Good	Good	Good	Good	Good
Canebrakes Restored to Desired Conditions	Poor	Poor	Poor	Poor	Poor	Poor

Table 2-17: Comparison of Ratings for Rare and Special Communities Decade 1 (Continued).

Indicators	Current	Alternatives				
		A	B	C	D	E
Caves, Mines, and Karst at Desired Conditions	Good	Good	Good	Good	Good	Good
Emergent Wetlands at Desired Conditions	Fair	Good	Good	Good	Good	Good
Native Grassland Restored to Desired Conditions	Poor	Poor	Poor	Poor	Poor	Poor
Bottomlands and Depressions at Desired Conditions	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good

Table 2-18: Comparison of Ratings for Rare and Special Communities Decade 5.

Indicator	Current	Alternatives				
		A	B	C	D	E
Glades and Barrens at Desired Conditions	Poor	Good	Good	Good	Good	Good
Montane Oak Forest at Desired Conditions	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Cliff and Talus at Desired Conditions	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Sinkholes, Depressions and Ponds at Desired Conditions	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Seeps and Fens at Desired Conditions	Fair	V. Good	V. Good	V. Good	V. Good	V. Good
Canebrakes Restored to Desired Conditions	Poor	Poor	Poor	Poor	Poor	Poor
Caves, Mines, and Karst at Desired Conditions	Good	Good	Good	Good	Good	Good
Emergent Wetlands at Desired Conditions	Fair	Good	Good	Good	Good	Good
Native Grassland Restored to Desired Conditions	Poor	V. Good	V. Good	V. Good	V. Good	V. Good
Bottomlands and Depressions at Desired Conditions	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good

All alternatives emphasize enhancing contribution of these communities to providing for diversity of plant and animal communities, recovering threatened and endangered species, and maintaining species viability. Table 2-19 displays aquatic species viability.

Table 2-19: Aquatic Species Viability.

Aquatic Species Viability Outcomes 1-5	Unit of Comparison-Number of Species/ Number of Watersheds				
Outcome 1, Low Risk	3/9	3/9	3/9	3/9	3/9
Outcome 2, Moderate Risk, FS May Positively Influence	6/34	6/34	6/34	6/34	6/34
Outcome 3, Potential High Risk, Little Opportunity for FS to Influence	15/39	15/39	15/39	15/39	15/39
Outcome 4, Potential High Risk, FS May Positively Influence	3/3	3/3	3/3	3/3	3/3
Outcome 5, Potential Very High Risk, Little Opportunity for FS to Influence	2/3	2/3	2/3	2/3	2/3

B - Maintenance of Productive Capacity of Forest Ecosystems—assessing the extent of forests and whether they can produce wood as well as non-wood forest products is crucial to ecosystem health (Table 2-20).

Table 2-20: Issue 4-Ecosystem Health and Sustainability.

Ecosystem Health/ Sustainability	Alternatives				
	A	B	C	D	E
Timber Management	**Unit of Comparison-Acres**				
Lands Classified Suitable for Timber Production	760,580	439,185	754,473	760,580	760,580
Regeneration in Decade 1	92,479	62,700	52,953	100,000	60,000
Regeneration in Decade 5	45,583	41,509	55,133	58,032	51,366
Harvested Acres Decade 1	145,000	130,000	145,000	145,000	145,000
Harvested Acres Decade 5	145,000	130,000	145,000	145,000	150,000
Growing Stock Available for Timber Production	**Unit of Comparison-MMCF/MMBF***				
Allowable Sale Quantity (First Decade)	162/814	133/666	156/782	154/770	146/731
Non-Timber Forest Products	**Unit of Comparison- Increase/Decrease/No Change**				
Mushrooms, Medicinal Plants, Firewood, etc.	NC	NC	+	+	+
Game Species-	NC	+	+	+	+
Non-game Species	NC	NC	+	NC	+

***MMBF-Million Board Feet.**
***MMCF-Million Cubic Feet**
+ = Increase

C - Maintenance of the Forest Ecosystem Health and Vitality—ensuring that a healthy forest ecosystem has the capacity across the landscape for renewal, recovery from a wide range of disturbances, and retention of its ecological resiliency, while meeting current and future needs of people for desired levels of values, uses, products, and services.

Prescribed fire is integral in restoring fire-adapted ecological communities and in lowering wildfire risks to people living in the wildland urban interface/intermix areas. Fire ecology research has resulted in the classification of ecosystems based on fire regime and condition classes (FRCC). FRCC are used to characterize both general wildland fire risk and ecosystem condition. The goal would be to have the majority of lands in FRCC 1. This class is characterized by

- Fire regimes within or near a historical range,
- Low risk of losing key ecosystem components,
- Departure from historical frequencies by no more than one return interval, and
- Intact and functioning vegetation attributes (species composition and structure) within an historical range.

Included in Table 2-21 are estimates of how each alternative would lower the condition classes.

Forest health threats include oak decline, native insects, non-native insects, non-native invasive plants, exotic diseases, and the risk of catastrophic fires. Oak decline is a complex of diseases involving interactions between environmental and biological stressors and subsequent attacks by insects and pathogens of opportunity. Drought is the primary environmental stressor. Biological stresses include stands of over stocked trees and old trees. Once stressed, these trees are more vulnerable to attack by insects and diseases.

Eighty-seven percent (87%) of the oaks are over 70 years old, and are considered vulnerable to attack at this age. The OSFNFs have a backlog of oak stands that need thinning. Thinning reduces competition for moisture and nutrients, while promoting better physiological condition of the remaining trees. The OSFNFs contain approximately 760,000 acres of hardwood forests.

There are a large number of native invasive species. One of the major pests on the Forests is the red oak borer. The red oak borer and white oak borer are native borer species, which are typically found at an endemic level within oak ecosystems. At endemic levels, these borers rarely kill the tree they inhabit. Beginning in 1999, after three years of extreme drought conditions, an oak decline related red oak borer epidemic began. This epidemic has affected an estimated 340,000 acres in the red oak/white oak/hickory forest types on the OSFNFs. Approximately 40,000 acres have greater than 50 percent oak mortality.

Where appropriate, the LRMP would include an identification of the ecological conditions necessary to lessen the threats from forest pests. The management direction in the LRMP should also be defined in such a way that managers can determine the appropriate response when forest pests threaten an area. The following are goals of the Revised Forest Plan:

- 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 2-21 compares the various forest health components by alternative.

Table 2-21: Issue 4-Ecosystem Health and Sustainability/Forest Health.

Ecosystem Health/ Sustainability/Forest Health	Alternatives				
	A	B	C	D	E
Thinning	**Unit of Comparison-Acres**				
Decade 1	42,522	47,458	82,047	35,000	65,000
Decade 5	38,762	29,429	60,624	35,000	60,000
Regeneration	**Unit of Comparison-Acres**				
Decade 1	92,479	62,700	52,953	100,000	60,000
Decade 5	45,583	41,509	55,133	58,032	51,366
Age Class Distribution (Hardwood)	**Unit of Comparison-Acres**				
Decade 1					
0-10	90,333	62,700	45,809	95,837	60,000
11-40	41,047	38,072	40,719	40,122	39,348
41-100	116,668	108,806	109,484	117,548	118,613
101+	522,684	511,250	566,913	507,296	552,302
Decade 5					
0-10	35,328	20,667	53,639	32,513	48,567
11-40	54,992	43,010	70,611	54,985	41,549
41-100	155,039	115,683	110,157	159,621	132,746
101+	525,373	541,467	528,518	513,684	547,401
Age Class Distribution (Pine)	**Unit of Comparison-Acres**				
Decade 1					
0-10	2,145	0	7,143	4,163	0
11-40	89,281	70,499	87,515	87,426	81,185
41-100	206,140	233,632	209,710	215,160	225,356
101+	18,211	51,094	18,870	19,052	18,820
Decade 5					
0-10	10,255	20,842	1,494	25,519	2,799
11-40	73,840	64,388	57,111	86,983	58,451
41-100	153,540	120,396	156,608	140,642	153,124
101+	78,142	149,599	108,025	72,656	110,987

Table 2-21: Issue 4-Ecosystem Health and Sustainability/Forest Health. (Continued)

Ecosystem Health/ Sustainability/Forest Health	Alternatives				
	A	B	C	D	E
Fire Regime Condition Class	**Unit of Comparison-Acres after Decade 1**				
FRCC 1	74,466	84,466	154,466	94,466	124,466
FRCC 2	151,892	151,892	151,892	151,892	151,892
FRCC 3	880,524	870,524	800,524	860,524	830,524
Prescribed Fire	**Unit of Comparison-Acres Burned Annually**				
Decade 1	70,000	80,000	150,000	90,000	120,000
Restoration Emphasis	**Unit of Comparison-Acre Allocated**				
Pine Woodland	22,570	0	98,196	0	97,629
Oak Woodland	30,858	0	168,967	0	154,704

D - Conservation of soil and water resources—determining whether soil is being managed to hold nutrients and prevent erosion, and if the water we depend upon is adequately protected. Table 2-22 focuses on the water and soils found on the OSFNFs.

Table 2- 22: Issue 4-Ecosystem Health and Sustainability/Watersheds & Soils.

Ecosystem Health/ Sustainability	Alternatives				
	A	B	C	D	E
Watersheds	**Unit of Comparison-Numbers of Watersheds**				
Number of watersheds with a change in risk to aquatic health	0	0	0	0	0
Soils	**Unit of Comparison-Percent of Harvested Lands**				
Percent short-term loss of soil productivity on harvested lands	10	9	10	10	11

E - Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of society—measuring the direct benefits that forests produce: forest recreation and tourism, wood products, non-timber forest products, cultural, social, spiritual values and needs, and community needs (Table 2-23).

Table 2-23: Issue 4-Ecosystem Health and Sustainability/Benefits to Society.

Ecosystem Health/ Sustainability Benefits to Society	Alternatives				
	A	B	C	D	E
Prescribed Fire	**Unit of Comparison-Acres**				
	70,000	80,000	150,000	90,000	120,000
Volume of Wood Products	**Unit of Comparison MMCF Per Decade**				
	163	133	156	154	146
Percent of Land Managed with and Emphasis on Recreation	**Unit of Comparison-Percent of NF Acres**				
	13%	15%	16%	13%	18%
Value of Hunting Related to Ecosystem Health	**Unit of Comparison-Trend**				
	NC	—	+	+	+
Change in Settings/Solitude	**Unit of Comparison-Trend**				
	—	+	+	—	+
SMS Integrity Levels	**Unit of Comparison- Percent With High Scenic Integrity Objectives**				
	67%	34%	56%	33%	47%

NC = No Change
— = Decrease
+ = Increase

Issue 5–Relationship of National Forest Management to Communities and Economies

The OSFNFs is a mosaic of federal land intermingled with tracts of private land, timber industry, and rural communities. Due to the large amount of private ownership (24% within the proclamation boundary), many communities, private landowners, and forest users are directly affected by forest management decisions.

In the past, local governments have not played much of a role in the national forest land management planning process. Since local governing bodies cannot mandate or direct the actions of federal government agencies charged with implementing federal land management policies, there has been little consideration or inclusion of national forest management issues in their policies.

Today, local governments develop land use plans to reduce conflicts resulting from incompatible uses and to exercise some control over growth and expansion. Local governments are increasingly attuned to the need for economic diversity. During the public comment period, much attention was focused on increasing revenues from recreation and tourism rather than on the sale of wood products. Significant changes in forest revenues to counties may affect the ability of the county to fund roads and schools. The Forest Service has the ability to affect jobs by direct employment, contracting, and indirect support of the private sector economy.

The OSFNFs contribute to local communities in many different ways through jobs, quality of life, and a sense of place. The people and social structures of these communities are changing as the urban/suburban population continues to grow and our society continues to move away from agriculture and a manufacturing based economy toward a technology and retail based economy. These changes have and will continue to affect national forest management.

The OSFNFs' importance to community economies varies according to the size of the community, its proximity to the Forests, and the diversity of its economy. Typically, the residents of rural communities in close proximity to national forest lands have used the Forests for both their livelihood and for recreation. The economic well being of the local community has generally been involved in manufacturing and processing of resources.

The Forest Service has a rural economic development responsibility as part of the US Department of Agriculture. Some public comments emphasized the importance of the timber industry to local community-base economies, while others noted the importance of the tourism industry and quality of life factors in building a strong economy. Sustainable community forestry was mentioned as one way we might accommodate both of these views. Some mentioned we should consider the impacts of our activities on adjacent landowners and the impacts of adjacent landowners on national forest management. Table 2-24 shows the impacts of each alternative on the economies of the local communities.

Table 2-24: Issue 5–Impact on Economies of Local Communities.

Communities and Economies	Alternatives				
	A	B	C	D	E
Percent Change in Employment	Unit of Comparison-Percent Change Over Current				
	14.6%	10.5%	12.7%	15.4%	11.4%
Percent Change in Labor Income	Unit of Comparison-Percent Change Over Current				
	23.5%	14.3%	19.7%	24.6%	17.5%
Payments to States/Counties	Unit of Comparison-Thousands of Dollars				
	$3.7	$2.9	$3.5	$3.4	$3.2
Cumulative Present Net value	Unit of Comparison-Millions of Dollars				
	$1,233	$1,106	$1,154	$1,134	$1,189

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CHAPTER 3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter summarizes the physical, biological, social, and economic environments of the OSFNFs and the effects of implementing each alternative on that environment. This chapter presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2, Alternative Development.

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

The Affected Environment and Environmental Consequences disclosures are required by the National Environmental Policy Act (NEPA), which 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.

RELATIONSHIP BETWEEN PROGRAMMATIC AND SITE SPECIFIC ANALYSIS

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 management areas will, in fact, occur to the extent necessary to achieve the goals and objectives of each alternative. However, the actual location, design, and extent of such activities are generally not known at this time. Those will be site-specific (project-by-project) decisions. 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 forest-wide basis, but is not to be applied to specific locations on the Forests.

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, but would be significant 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 ENVIRONMENT

The physical environment is the non-living portion of the environment upon which the living organisms depend—air, soil, water, geology, and climate. This section begins with a description of the ecological classification of the Ozark-St. Francis National Forests (OSFNFs). Ecological classification is a system, which classifies land and water at various scales through integrating information about climate, geology, landform, soils, water, and vegetation. This classification is a tool to provide a more ecological and scientific basis in land and resource management planning.

Ecological classification is useful for:

- Evaluating the inherent capability of land and water resources,
- Predicting changes occurring over time,
- Evaluating effects of management,
- Allocating land to management areas,
- Selecting appropriate management indicators, and
- Discussing and analyzing ecosystems and biodiversity at multiple scales.

GEOLOGIC RESOURCES

The geologic setting is the foundation for a variety of ecologic elements. Geologic materials and geologic processes control or influence a host of ecological factors. Some of these are as follows:

- Slope aspect,
- Slope steepness,
- Area of landforms and associated vegetation,
- Distribution and composition of soil parent material,

- Structure and composition of vegetation,
- Physical character of wetlands, riparian areas, and stream substrates, and
- Quantity and quality stream water and ground water; and the natural disturbance regime.

Surface geologic processes are an important part of the natural disturbance regime in the OSFNFs. These processes include erosion; sediment transport, and deposition; landslides (mass wasting); floods; changes in stream channels and groundwater flow; and the formation of caves, sinkholes, and other karst features. These processes have been part of the natural disturbance regime for the past several hundred thousand years and affect the Forests in varying degrees every year.

Uplifting, folding, and faulting formed the Ozark Highlands. Stream erosion has removed some original surface rock and dissected the area into hills and mountains with rock outcrops, cliffs, pedestal rocks, natural bridges, deep valleys, and narrow ridges. The Ozark Highlands include the Springfield and Salem Plateaus. Springfield Plateau surface rock is composed of limestone and chert; however, shale is sometimes found at the surface. Salem Plateau surface rocks are mostly limestone or dolomite with a few large sandstone outcrops. Caverns, large springs, and sinkholes occur in the Salem and Springfield Plateaus.

The Boston Mountains are strongly dissected tablelands 1,900 to 2,300 feet above sea level with narrow steep-sided valleys 500 to 1,250 feet deep. Resistant sandstone is the surface rock on ridge tops. Shale is sometimes found at the surface on side slopes and in valleys.

Crowley's Ridge on the St. Francis NF is a unique highland that rises steeply above the surrounding flat terrain. The ridge has a thick wind deposited soil mantle, which has an extreme erosion hazard on road shoulders and in drainage channels. The soil structure is stable when the soil is dry, but quickly becomes unstable when the soil becomes saturated with water.

The St. Francis River Alluvial Plain, also on the St. Francis NF, is made up of recent river deposited sediments.

Direct and Indirect Effects

The alternatives have standards to protect the Forests' geologic resources including caves, sinkholes, groundwater, waterfalls, fossils and paleontological resources, and unusual landforms like Pedestal Rocks. All alternatives include standards that require management activities to include measures to avoid, minimize, or mitigate adverse effects on geologic resources with identified values (scientific, scenic, paleontologic, ecological, and recreational, drinking water). Management activities that involve moving, earth such as road construction have the most potential to affect geologic resources. The potential effects vary depending upon the type, size, and sensitivity of the resource, and the magnitude of the ground disturbance. Based upon earth-moving ground disturbance, the ranking of the alternatives, descending from greatest to least potential impacts, are Alternative D, C, E, A, and B.

Geologic Hazards

A geologic hazard is a natural event or condition that involves geologic processes that harm or interfere with human activity. Mass movement, earthquakes, flooding, and development of karst features are examples of geologic hazards.

The main geological hazards are landslides and soil slippage in the Boston Mountains. Landslides occur on an infrequent basis and occur mostly because of large amounts of rainfall in a short period. In karst areas of the Ozark Highlands surface, disturbing activities need to be carried out with care to avoid possible surface failures into caverns. Dam locations require special care because of limestone formation porosity. The main hazards on the St. Francis NF are soil erosion and slope failure due to storm events or activities that concentrate water.

Karst

Direct and Indirect Effects

Management activities (e.g., construction and maintenance of roads, trails, log landings, and other facilities; and groundwater withdrawals for recreation facilities) may cause, or contribute to causing:

- Ground subsidence including sudden sinkhole collapse,
- Sinkhole flooding,
- Groundwater pollution including accidental spills of petroleum products.

Urban and residential development and agricultural waste management off the Forests have the potential to impact karst hazards and features. Those alternatives that have more ground disturbance, such as more miles of road construction/reconstruction and more acres of timber harvested (acres treated), are estimated to have more potential to affect karst-related hazards than those alternatives with less ground disturbance. The ranking of the alternatives, descending from greatest to least potential impacts, are: Alternative D, C, E, A, and B. The standards included in all alternatives would avoid or minimize adverse effects on karst-related features.

Cumulative Effects

Free range grazing of cattle and hogs and unregulated fires in the past may have impacted karst hazards and features. Urban and residential development and agricultural waste management off the Forests have the potential to impact karst hazards and features. Forest management activities discussed above also have the potential to affect karst hazards and features. Considering past, present, and future actions none of the alternatives is expected to significantly increase karst hazards or significantly impact karst features.

Stratigraphic Summary of the Ozark-St. Francis National Forests

Following is a stratigraphic summary of the geologic formations that occur on the OSFNFs (McFarland 2004).

Ozark National Forest

Arkansas Valley. Pennsylvanian clastic sediments deposited on the margin of a continental shelf primarily by deltas and reorganized in part by marginal marine processes dominate the Arkansas Valley. Structurally the area is made up of broad synclines (troughs) with relatively narrow intervening anticlines (arches). The axes of these folds generally trend east to west. Most of the observed faulting is normal, but some thrusts faults are noted, associated with the anticlines in the southern part of the province. The synclines are often the most conspicuously present positive topographic features, formed from more rapid erosion of underlying shales, once capping sandstones were breached on the crests and flanks of the surrounding anticlines.

The Ozark Plateaus Region of Arkansas is made up of generally flat-lying Paleozoic age strata divided into three plateau surfaces. The lowest and northern-most plateau is the Salem Plateau and is generally underlain by dolostones, sandstones, and limestones of Ordovician age. The Springfield Plateau stands above the Salem a few hundred feet and is generally capped by lower Mississippian age limestones and cherts. The southernmost and highest plateau of the Ozarks is the Boston Mountains. Pennsylvanian age shales, siltstones, and sandstones dominate the Boston Mountains. All of these plateaus are deeply dissected by numerous streams throughout the area. The faulting in the Ozarks is generally normal with most faults displaying a displacement down on the southern side. However, some observations reveal that a few strike-slip faults may be present. Gentle folds are noted but are generally of very low amplitude. The depositional environment of the rocks found in the Arkansas Ozarks is one of a relatively shallow continental shelf, sloping toward deeper water generally toward the south. This shelf emerged many times during the Paleozoic resulting in numerous unconformities throughout the sequence.

St. Francis National Forest

Mississippi Embayment and Gulf Coastal Plain. Eastern and southern Arkansas is underlain by Cretaceous age through recent sedimentary deposits with small areas of igneous intrusions of Cretaceous age. Cretaceous sedimentary deposits are exposed in southwestern Arkansas and represent shallow, marginal, and often restricted marine environments. Tertiary marginal marine and coastal plain continental deposits with a veneer of Quaternary terrace and alluvial deposits dominate southern Arkansas. Quaternary terrace and alluvial deposits with minor exposures of Tertiary units dominate eastern and northeastern Arkansas. At least three terrace levels are recognized in the region. The Mississippi Embayment manifests a north-south linear erosional remnant. Crowley's Ridge is generally capped by Quaternary loess and preserves minor exposures of Tertiary deposits along its margins. Topographically, the entire area ranges from low hills to essentially flat terrain.

Climate

The climatic regime for the OSFNFs area is characterized as a temperate climate due to its mid-latitude location in the continental interior of North American. The air masses responsible for the regional weather patterns originate from source areas including the eastern Pacific Ocean, western United States, the Gulf of Mexico, and Canada. General atmospheric circulation patterns generally move these air masses from west to east across Arkansas. Average temperature and precipitation patterns for the Forests are the result of these moving weather systems as well as local interactions between topographic variations. For example, mountain induced lifting of the air can affect local levels of precipitation (OOHA 1999).

During the winter, large north to south variations in maximum temperature occur across northern Arkansas. Large variations in maximum temperature tend to occur north of the Boston Mountains because the topography restricts the southern movement of cold air masses. During the summer, the Ozark Plateau experiences lower daily maximum temperatures than the surrounding areas. Daily variations in temperature are more significant during the late fall and winter seasons because there is less atmospheric moisture to control these day/night temperature variations. Extreme temperatures (defined as 20°F above or below average daily temperature) show the following patterns: generally during the summer, more below normal extreme temperatures than above normal extreme temperatures occur; whereas, generally during the winter, more above normal extreme temperatures than below normal extreme temperatures occur. This suggests that extreme temperature events tend to control seasonal temperatures instead of magnifying seasonal extremes (OOHA 1999).

Average yearly precipitation across the Forests reflects the large-scale northwest-southeast variation in rainfall over the United States with north Arkansas averaging 45 to 55 inches of rain per year. In general, the wettest months of the year for the Forests are March, May, and November. The driest months are July, August, and January. As springtime temperatures rise, an increase in the occurrence of convective precipitation events becomes evident (OOHA 1999).

Extreme precipitation can lead to floods, particularly in the flashy streams of the Ozarks. Floods can decrease nutrients, trace metals, and organic chemical concentrations in streams. They can also transport, deposit, and expose gravel in streambeds, which can enhance fish spawning. Floods can increase nutrient levels in reservoirs resulting in algal blooms and lower dissolved oxygen concentrations, which inhibit aquatic habitat. Property and infrastructure damage from flooding can create severe economic stress to local communities (OOHA 1999). Flooding characteristics in Arkansas depend on the season. In the winter, flooding is generally widespread and lasts for several days. Flooding in the summer is typically local and short-lived (USGS 2001). For rural areas of Arkansas, the relationships between flood characteristics and watershed were found to be determined by different factors based on physiographic zones as described in the U.S. Geological Survey (USGS) Fact Sheet 128-97. For the Boston Mountains and Ozark Highlands, watershed area

determines flood flows for specific recurrence intervals. In the Arkansas River Valley, recurrence interval flood flows are determined by watershed area and slope of the main river channel (USGS 1998).

The most extensive flood in Arkansas during the period from 1970 to 1989 was the flood of December 1982. Thirty-two percent of the states' stream-flow gauging stations recorded significant discharges and mainly affected the northern and western parts of the state. Maximum discharges matching or exceeding the 100-year recurrence interval were measured at 21 gauging stations. During 1973 and 1974, Arkansas had unusually large precipitation amounts. A flood during June 1974 resulted in discharges with 100-year recurrence intervals at 6 stream-flow gauging stations. In April 2004, a precipitation event similar to that of the December 1982 event occurred over northern and western Arkansas. In some areas, 13 inches of rain were measured for a 24-hour period. Rainfall continued for a three-day period. While published records from this flood have not been produced, many of the rivers and streams within the Forests exceeded the 100-year recurrence flood flows.

Thunderstorms across the Forests are greatest during the spring, summer, and fall with 10 to 25 events occurring during each of these seasons. Although small, the intense rainfall associated with thunderstorms can cause localized flooding within small watersheds. Meso-scale storm events are generally larger in size and duration than thunderstorms and can produce more significant widespread flooding of larger draining areas. These are more common during the summer and fall. Winter and spring months see an increase in the number of extra tropical cyclone and frontal passages. These are most responsible for large riverine flooding and major river basin floods. Orographic (mountain) precipitation effects produced by topographic divides found in the national forest land base play an important role in localized rainfall patterns. Moisture-rich prevailing winds can cause flooding events to occur along the windward side of these topographic divides.

Extreme precipitation events, defined as 2 inches of rain in 24 hours, were found to occur 150 to 200 times in northern Arkansas between 1950-1993. The likelihood of these extreme events is greater in spring than in winter (OOHA 1999).

Droughts

There have been 6 major droughts in Arkansas during the last 60 years. Table 3-1 shows the duration of each drought.

Table 3-1: Duration of the major droughts in Arkansas (1954-2001).

Drought Beginning	Drought Ending
1954	1956
1963	1967
1970	1972
1976	1978
1980	1983
2000	2001

Droughts have a pronounced effect on the water use in the State. Nearly 5,900 million gallons of water per day (excluding water diversions for hydroelectric-power generation) were withdrawn from ground- and surface-water sources in 1985 (USGS 1986). Less water was withdrawn from groundwater sources for 1985, a non-drought year, than 1980. The greater withdrawals in 1980 were partly caused by the drought. Large, sustained groundwater withdrawals for irrigation purposes during the early 1980s caused substantial water level declines in parts of the State. Water levels in wells throughout much of the alluvial aquifer in the State (mainly areas not encompassed by the OSFNFs) had declines of as much as .5 feet. This resulted in the need for irrigation supply wells to be drilled to deeper aquifer systems (USGS 1990). Water-use management during droughts is a responsibility of the Arkansas Soil and Water Conservation Commission (ASWCC). The ASWCC issues permits for dam construction, registers diverted water from streams and lakes, determines the State's overall water usage, and maintains the State's water plan. These measures are designed to address both serious groundwater-depletion problems throughout the State and water shortages in general (USGS 1990).

Tornados

The northern section of Arkansas falls within the southeastern section of "Tornado Alley." Favorable atmospheric conditions for tornado formation occur frequently in this area. Arkansas ranked 16th in the number of tornados reported between 1950 and 1994. Although tornados have been reported in every month, April and May are when tornados are most likely to occur with increased tornado activity in January, February, and March (OOHA 1999).

SOILS

Affected Environment

Soil is a non-living system that represents a finite resource. It develops slowly from various parent materials and is modified by time, climate, macro-organisms, microorganisms, vegetation, and topography. Soils are complex mixtures of minerals, organic compounds, and living organisms.
Two hundred four (204) soil map units were described on the OSFNFs. Most soil map units consist of one soil, but some are made up of two or more soils. The soils have been grouped by ecological section to discuss the important soil properties on a forest-wide basis.

Ozark NF soils are grouped into Boston Mountain-Arkansas Valley Sections and Ozark Highlands Section soils. St. Francis NF soils are grouped in the Mississippi Alluvial Basin Section then sub-grouped into Crowley's Ridge Subsection and St. Francis River Alluvial Plain Subsection soils.

Ozark National Forest

Boston Mountain–Arkansas Valley Sections soils were formed in sandstone and shale parent material. These are deep to shallow clayey and loamy soils with low

inherent fertility and low-to-moderate moisture supplying capacity. Soil problems include seedling mortality, surface compaction, slight landslide potential, and erosion.

Ozark Highlands Section soils were formed mainly in limestone and chert parent materials but some were formed in sandstone and shale parent materials. They have generally low erodibility and moisture-supplying capacity and are very deep cherty and silt loams. Soil problems include droughtiness and slight landslide potential.

St. Francis National Forest - Mississippi Alluvial Basin Section

Crowley's Ridge Subsection soils were developed in Pleistocene wind blown sediments. These soils are erodible, deep silt loams with high productivity and moisture holding capacity. Gully erosion and piping occur where water concentrates from road runoff, compacted pastures, or other activities.

St. Francis Alluvial Plain Subsection soils were developed in unconsolidated alluvial sediments. These soils are deep stratified clays and loams that have high productivity and moisture holding capacity, frequent flooding, and a high shrink-swell potential.

Direct and Indirect Effects

This Final Environmental Impact Statement (FEIS) presents an overview of alternatives and general effects on the soil resource. When projects are proposed, site-specific analysis occurs, and mitigation is based on the potential capability and limitation of the soils in the project area. For this FEIS, the categories affecting productivity discussed include compaction, soil displacement, and erosion. Region 8 Soil Quality Standards identify conditions where soil impairment is not occurring when "at least 85 percent of an activity area is left in a condition of acceptable potential soil productivity" (USDA 2002).

Effects by Resource

The following discussion provides some background information regarding the direct or indirect environmental effects common to soil resources from forest management and uses of forest resources. Any activity that disturbs the land surface, decreases vegetation cover, or alters vegetation communities can affect soils. The primary management or resource activities that could affect the soil resource are:

- **Recreation:** Recreation activities directly affect soils by exposing and compacting soils, increasing the potential for erosion and sedimentation.

- **Roads:** Roads expose and compact soils, and alter surface water flow. When left open, they contribute to higher erosion rates than closed roads that have proper water controls and surface cover.

- **Vegetation Management:** Vegetation management activities that may affect soils include timber harvesting, site preparation, timber stand improvement,

prescribed fire, skid trail construction, and wildlife habitat improvements. Loss of the protective soil cover (litter) from ground disturbance can increase erosion while decreasing soil productivity.

- **Fire Management:** Prescribed burning directly affects soils by removing a portion of the vegetation cover, which may expose soil to erosion. Control fire lines also expose mineral soil. These factors can reduce soil productivity. The significance of this varies widely depending on the soils, topography, and the intensity of the burn.

- **Minerals Management:** Extraction of locatable or leasable minerals directly affects soils by removing vegetation, and often the entire soil material overlying the minerals. Possible effects include erosion and loss of soil productivity. Mineral sites are restored when use ends.

Effects of Recreation on Soils

Overuse of campsites can result in soil compaction and deterioration of the vegetation. These effects can lead to increased surface-water runoff and possibly gully formation. These effects are expected to be similar under all alternatives. There are numerous dispersed sites throughout the Forests and, where these sites are used in moderation, impacts are localized. In heavily used areas, vegetation destruction, soil compaction, and displacement can occur.

There are 3,110 acres of developed recreation areas in each alternative, which is less than 1 percent of the total national forest land area. There are 24 campgrounds, 3 boat launches, and 12 day-use sites in these developed recreation areas. The number of campgrounds, boat launches, and day-use sites may increase under Alternatives B and E. The number of day-use sites may increase under Alternative C. Soil compaction, displacement, and erosion could increase in localized areas in campgrounds, boat launches, and day-use sites if the number of these facilities increase under Alternatives B and E. Soil compaction, displacement, and erosion could increase in day-use sites if the numbers are increased under Alternative C. Compacted, displaced, and eroded areas will be ripped or disked, fertilized, and seeded to restore soil productivity.

Dispersed recreation occurs along trails, roads, and in the general forest area. Some soil compaction, displacement, and erosion are expected to occur in localized areas because of dispersed recreation. The impacts are expected to be slightly higher under Alternatives C and E because the Indian Creek and Upper Buffalo Dispersed Recreation Areas are proposed. The Upper Buffalo Dispersed Recreation Area is 6,115 acres under Alternatives C and E, which is less than 1 percent of the total land area of the Forests. The Indian Creek Dispersed Recreation Area is 17,844 acres under Alternative C and 17,100 acres under Alternative E, which is about 1.4 percent of the total land area of the Forests. These proposed dispersed recreation areas are planned for non-motorized use, so the impacts to soil will be much less than motorized use.

The miles of single-use trails will remain the same under Alternatives A and D and increase under Alternatives B, C, and E. There will be some increase in soil impacts as the miles of trails increase depending on how much use the trails get, but the soil impacts are expected to be small for all of the alternatives. A small loss in soil productivity will result under Alternatives B, C, and E because the area under the trails will be compacted and taken out of production. The overall loss in soil productivity is expected to be very small because the trails are narrow and will not have much impact on trees and shrubs growing along the trails.

The miles of multiple-use trails will stay the same under Alternatives A, C, and D and may increase under Alternatives B and E. The impacts to soil productivity may increase under Alternatives B and E due to the increase in miles of multiple-use trails depending on how much the trails are used.

All alternatives limit off-highway vehicle (OHV) use to designated roads and trails. This designation has resulted in some soil erosion, compaction, displacement, and puddling. Although many of these impacts are caused by illegal activity, many impacts also occur during hunting seasons when soils are often wet and highly susceptible to damage. The extent of this impact has not been determined. Regardless, significant localized impacts exist throughout the Forests. The control of illegal use would reduce damage to soil resources, and allow law enforcement to be more effective in addressing this activity. One factor in mitigating effects of trail use is to maintain trails on a regular basis to keep erosion and runoff under control.

Trails are similar to roads in impacts, but the impacts may be less because trails are narrower and generally do not provide access for heavy vehicles. However, trails are often steeper and many are not designed as well as roads. The type and intensity of trail use can affect erosion and compaction. Lightly used trails are usually narrower and may have some protective vegetation. Tires, hooves, or feet can loosen soil. Foot and horse trails are sometimes steeper than motorized trails, but are usually not as wide and do not tend to have as many cut slopes.
Although localized effects do exist, the impacts of trails on the soil resource from a forest-wide perspective are not significantly different from one alternative to another, and the total impact of trails is well within acceptable limits.

Overall, recreational use is expected to increase on the Forests, and is similar between alternatives.

Effects of Roads on Soils

Forest roads can significantly affect site productivity by removing and displacing topsoil, altering soil properties, changing microclimate, and accelerating erosion. Road construction and reconstruction require vegetation removal, soil disturbance, and slope re-contouring. Soils must be compacted, hardened, and generally surfaced with stone. Losses of productivity associated with road-caused accelerated erosion are site specific and highly variable in extent.

The permanent or classified roads on the Forests have been dedicated to a non-productive use. Except where the erosion extends beyond the road and drainage ditches, it has little effect on soil productivity. Sediment from this erosion, however, will often affect water quality and aquatic habitat if it enters streams. Road cuts can also undermine unstable slopes and lead to landslides, especially in steep terrain.

Road designs consider these potential effects. Proper design and maintenance can mitigate these impacts. However, some localized impacts still occur, particularly when roads are not regularly maintained. Roads are located and constructed either to avoid or, if this is not feasible, mitigate problems associated with unstable or highly erodible soils, steep slopes, and wet areas. If user needs are satisfied, there is less likelihood of off-road use, which can seriously degrade soils.

All alternatives contain direction that allows closure of unnecessary roads to prevent resource damage. Road closures range from barriers (gates) to obliteration and decommissioning. Barriers reduce traffic-use impacts that cause eroding and unstable roads, but do not restore soil productivity. Restoring stable grades, natural drainage, and ground cover are critical to restoring and protecting soil productivity.

Table 3-2 shows the projected acres that will be taken out of production due to their conversion to roads. Temporary roads will be taken out of production during the period that they are needed for access and then returned to production. Temporary roads will be ripped or disked, fertilized, and seeded to return them to production when they are no longer needed. The Roads Analysis Process will be used to identify permanent roads that are no longer needed. These roads will be decommissioned and returned to production. The greatest number of acres is taken out of production due to roadwork for Alternative D followed by Alternatives A and C with the next highest number of acres removed from production due to roadwork. Decommissioning of existing road miles is expected to exceed the construction of new road miles for Alternatives B, C, and E. Decommissioning of existing road miles is expected to equal the construction of new road miles for Alternatives A and D.

Table 3-2: Estimated Soil Acres Taken Out of Production Due to Projected Road Work on OSFNFs (2005-2055).

Estimated Soil Acres Taken Out of Production Due to Projected Road Work	Alternatives				
	A	B	C	D	E
Decade 1					
Permanent Roads (Acres)	23	19	22	24	21
Temporary Roads (Acres)	233	190	223	240	210
Decade 2					
Permanent Roads (Acres)	23	19	23	23	21
Temporary Roads (Acres)	233	191	226	231	210
Decade 3					
Permanent Roads (Acres)	23	19	22	29	22
Temporary Roads (Acres)	233	191	225	289	217
Decade 4					
Permanent Roads (Acres)	23	19	22	26	23
Temporary Roads (Acres)	233	193	223	270	227
Decade 5					
Permanent Roads (Acres)	23	19	22	25	23
Temporary Roads (Acres)	233	192	223	254	230

In addition to the classified roads discussed above, there are "unclassified" roads on the OSFNFs. Forest users create these unclassified roads. Unfortunately, these routes are often on poor locations that result in resource damage to streams and soils. Unclassified roads are identified during the Roads Analysis Process (RAP), which is done during project planning. These unclassified roads are obliterated to restore them to productivity when funds become available. Not all obliterated roads are successfully restored because some are inappropriately "reopened" by forest users before they are completely restored.

Effects of Timber Harvesting on Soils

Activities associated with timber harvesting can cause soil compaction, soil displacement, soil puddling, and erosion. Generally, the actions requiring removal of ground cover and displacement of soil material are most responsible for potential impacts. Dragging logs to the log landing, and blading skid trails and landings can cause displacement. Use of logging equipment such as skidders to bring logs to a central location, and the routes used by trucks to remove logs from the harvest area can cause compaction, especially if the soils are wet and fine textured or clayey. Erosion occurs when the litter layer is removed and the root mat is cut by blading or driving heavy equipment over the soil. Erosion accounts for less than 1 percent of the soil impacts due to timber harvesting on the Ozark NF and about 6 percent of the timber harvest soil impacts on the St. Francis NF (Weeks 1996).

Standard provisions in timber sale contracts allow the Forest Service to suspend logging operations during wet periods to minimize the risk of compaction. Sale preparation and administration procedures along with Forest LRMP Standards and direction in Arkansas' BMPs (Arkansas Forestry Commission 2002) are used to protect soil productivity.

All of these potential detrimental effects (compaction, displacement, puddling, and erosion) can be mitigated through the implementation of Forest LRMP Standards and Arkansas' BMPs. These standards and practices include the use of designated skid trails, sub soiling, seeding for erosion control, water barring, avoidance of unstable slopes, and limiting equipment use during wet periods. Forest LRMP Standards and Arkansas' BMPs apply to all alternatives.

From a forest-wide perspective, impacts of timber harvest on soils differ between the alternatives. Table 3-3 displays estimated acres of soil impacts, and the percent of the harvest acres sustaining soil impacts by alternative. Alternative C has the highest estimated number of acres of soil impacts and Alternative B has the lowest. Alternative E has the highest number of acres of soil impacts and the highest percent compared to the acres harvested. The estimated effects to soil due to timber harvesting for all alternatives is well within the requirement for retaining at least 85 percent of an activity area in a condition of acceptable potential soil productivity.

Table 3-3: Estimated Effects of Timber Harvest on Soils for the OSFNFs for Decades 1-5.

Estimated Effects of Timber Harvest on Soils	Alternatives				
	A	B	C	D	E
Decade 1	**Ozark National Forest**				
Acres of Soil Impacts	14,362	11,931	15,043	14,105	13,599
% of Harvested	10	9	10	10	10
Decade 1	**St. Francis National Forest**				
Acres of Soil Impacts	0	542	884	542	937
% of Harvested	0	7	10	7	9
Decade 2	**Ozark National Forest**				
Acres of Soil Impacts	9,120	8,175	12,542	9,312	9,035
% of Harvested	6	6	8	6	6
Decade 2	**St. Francis National Forest**				
Acres of Soil Impacts	32	329	794	329	696
% of Harvested	9	8	9	8	9
Decade 3	**Ozark National Forest**				
Acres of Soil Impacts	12,724	10,521	13,122	11,612	13,573
% of Harvested	9	8	9	8	9
Decade 3	**St. Francis National Forest**				
Acres of Soil Impacts	46	122	127	122	239
% of Harvested	9	6	9	6	9

Table 3-3: Estimated Effects of Timber Harvest on Soils for the OSFNFs for Decades 1-5. (Continued)

Estimated Effects of Timber Harvest on Soils	Alternatives				
	A	B	C	D	E
Decade 4	**Ozark National Forest**				
Acres of Soil Impacts	12,575	10,275	13,057	11,922	13,206
% of Harvested	9	8	9	8	9
Decade 4	**St. Francis National Forest**				
Acres of Soil Impacts	48	443	203	443	304
% of Harvested	9	9	9	9	9
Decade 5	**Ozark National Forest**				
Acres of Soil Impacts	11,680	8,844	13,529	11,502	13,869
% of Harvested	8	8	9	8	9
Decade 5	**St. Francis National Forest**				
Acres of Soil Impacts	36	367	162	367	195
% of Harvested	9	8	9	8	9

Effects of Range Management on Soils

The main potential impacts of livestock grazing on soil productivity are compaction and accelerated erosion, generally from over-grazing or poor maintenance. Range management occurs on approximately 356 acres of improved pastures on the St. Francis NF and 3,129 acres of improved pastures and 13,198 acres of woodland range allotments on the Ozark NF.

Livestock grazing is managed by following a site specific Allotment Management Plan supported by a thorough analysis of the range situation as directed by the Forest Service Manual and pertinent handbooks. Additional guidance is developed in the environmental assessment process. All grazing use is by permit only and yearlong permits are discouraged. Term grazing permits are preferred over other permit types because of their stronger controls and management flexibility.

Livestock grazing within standards has minimal impact on soils. In localized areas such as livestock paths, soils can be compacted and vegetation damaged or removed. Livestock paths tend to collect runoff and can cause erosion. These instances, however, are localized. Erosion is largely a function of inherent soil erosiveness, slope, and soil cover. Periods of drought stress the vegetation and make the allotments more susceptible to compaction and erosion. Managing grazing to retain effective vegetation cover can mitigate livestock-induced compaction and erosion. Scattered patches of compacted soil occur in riparian areas where cattle congregate. Small areas of bare soil develop where the soil is compacted to the point that plants cannot grow. Subsoiling, fertilization, and liming help restore the soil and maintain the vegetative cover. The Forests have begun to exclude cattle from riparian areas on range allotments to protect riparian functions and values. Overall, across the allotments, soil compaction and erosion are minor.

Effects of Fire Management on Soils

The effects of prescribed fire and wildland fire on soils are summarized here, but are more fully described in Vegetation Management in the Ozark/Ouachita Mountains Volume II, Appendix B–Effects of Prescribed Fire on Soil and Water in Southern National Forests (USDA Forest Service 1990). Fire affects soil through transfer of heat into the duff layer and underlying soil. These effects vary considerably depending upon fire intensity, duration, and soil conditions. The direct impacts to soil include charring of the ground surface, possible development of water repellent conditions, and acceleration of erosion for about one to three years depending upon fire intensity, duration, and soil conditions. Burned areas can experience a loss in plant nutrient reserves and a reduction of microbial populations. Soil productivity may be slightly diminished. In some instances, the burned area benefits from increased availability of nitrogen, phosphorous, calcium, magnesium, potassium, and sulfur.

A major factor relative to the impact of fire on soil is the extent to which fire kills vegetation and burns the organic layers on the soil surface. When fire consumes all the surface litter and vegetation canopy, soils are exposed to erosive effects of precipitation and any subsequent runoff. Severe fire can increase the rate of erosion; however, the effects of severe fire are typically isolated and short-term. Wildland fires tend to accelerate surface erosion more than prescribed burns because the potential for higher severity burns is greater, and the placement of control lines is more indiscriminate than planned prescribed fire containment lines. Over time, much of the vegetative cover can be re-established on disturbed sites through succession. Eventually, burned soils will stabilize and the hydrologic function of the soils will return to normal.

Severe wildfires often destroy vegetation and detrimentally burn soils. A high intensity fire could adversely affect site productivity by influencing the physical, chemical, and biological properties of the soil. The physical effects could include loss of structure, reduction in porosity, and change in color. Reduced infiltration can affect the hydrology, which can in turn affect stream channel morphology and cause a resulting shift in stream aquatic habitat. Areas severely burned in wildfires can receive emergency rehabilitation to reduce or minimize soil degradation.

Firefighting forces suppress most wildfires in Arkansas while they are small. These fires often occur at times of the year and under conditions so that fire intensities are low or moderate resulting in little damage. Some fires occur on "high fire danger" days where low relative humidity and wind result in larger, more potentially destructive wildfires. Although infrequent, when summer and fall droughts occur, wildfires in Arkansas can be very destructive.

Prescribed fires can potentially result in the same types of impacts on soils as wildfires; however, these burns are generally planned to burn at low to moderate intensities, limiting adverse impacts. These fires are often designed to reduce fuel loadings that reduce the likelihood of detrimental impacts from subsequent wildfires.

Because these fires are planned, there is usually less fire line on steep slopes, which have a higher potential to erode. Fire lines are water barred and seeded after the fire is out to prevent erosion. Rehabilitation is initiated when severe impacts do occur.

With low to moderate intensity fires, soil productivity would be maintained. Some areas may see a short-term increase in nutrient availability. Lethal temperatures for soil organisms would typically be confined to the upper inch or two of the soil. Sufficient ground cover typically remains in place to protect the soil surface from accelerated erosion.

The effects of fires on soil are usually short-lived and not significant except where fire intensities are high or the underlying soil resource is fragile. Prescribed fires that occur every three to seven years are usually light to moderate in severity. Adverse effects from a single burn are minimal. Soil physical properties are not affected. Loss of organic matter is about 5 percent. Nitrogen loss may be 100 to 150 pounds per acre for dormant season burns and 400 to 450 pounds per acre for growing season burns. Moderate burns cause minor erosion because they expose soil on less than 20 percent of the area and recovery usually takes one year. Light burns cause no erosion because they expose almost no soil (Dissmeyer and Stump 1978). Prescribed underburns are usually light to moderate, so their effect on erosion is generally negligible.

Prescribed underburns do not cause significant leaching losses because nutrients are returned through uptake by unburned plants. Moderate burns produce neutral nitrogen budgets.

Long-term effects on nitrogen are combined with effects on soil biota, physical properties, and organic matter to judge overall risk to soil productivity. Risk to productivity for 5+-year dormant season prescribed underburns is minimal on good and fair soils and low on poor soils.

The risk for potential soil impacts from prescribed fire for Alternative A would remain the same as for the current Forest Plan. The risk for potential soil impacts from prescribed fire would increase under Alternatives B, C, D, and E because the acres burned would increase by 14 percent, 114 percent, 28 percent, and 71 percent, respectively, compared to the acres burned under Alternative A. The increase in the risk for potential soil impacts due to burning more acres would not be directly proportional to the increase in acres burned. The increase in the risk for potential soil impacts would be related more to the intensity, duration of the burn, and the soil conditions in the burn. Acres of soil impacted by fire line construction are estimated to be 31, 35, 65, 39, and 52 respectively for alternative A through E.

The regional soil quality standards (USDA 2002) protect against detrimentally burned soils caused by direct management actions, and apply to all alternatives. The impacts of prescribed fire on soils are expected to stay within established limits for all alternatives.

Effects of Minerals Management on Soils

Minerals activities on the Ozark NF are primarily associated with gas exploration and production, associated gas pipelines, and disposal of common variety mineral materials (primarily surface "building" stone and pit-run gravel).

Fifteen gas wells were drilled on the Ozark NF in the current Plan period for an average of one well per year. Each well affected one to two acres for a period of 30 to 60 days. Dry wells were plugged and abandoned and sites fully reclaimed according to Federal and State regulations. Producing wells were partially reclaimed with only approximately ¼ to ½ acre needed for production operations. Reclamation included disking, fertilizing, and seeding. These helped restore productivity to the disturbed soil. The soil under the area needed for the producing wells has been taken out of production.

The Ozark NF has 14 permitted gas pipelines affecting a cumulative total of 409 acres. These pipelines mainly occupy road Rights-of-way (ROWs) in linear covered and reclaimed trenches. Vegetative clearing widths vary from 10 to 60 feet. Lengths range from 50 feet to 50 miles (seven are less than ½ mile in length, five are from 2-miles, one is 17 miles, and one is 50 miles). The soil along road ROWs has already been taken out of production and dedicated for road use. There is the potential for localized erosion along pipelines where off-road use occurs.

Stone removal operations on the Ozark NF are all dispersed short-term removal operations (no excavations for the removal of stone). Soil impacts from stone removal operations are negligible. Gravel pits on the Forests are long-term impacts to allow controlled centralized access to essential pit-run aggregate resources. Pit sizes are all one-half acre to three acres and designed to prevent water runoff and erosion. There are no full-time operating pits. All pits on the Ozark NF are worked intermittently primarily by counties and Forest Service contractors removing material for public projects as needed.

Alternatives A, B, and D place a high emphasis on energy production (gas) and are high in surface stone removal (common variety mineral materials). Alternative E places a moderate emphasis on energy production (gas) and high emphasis on surface stone removal.

Alternative C places a moderate emphasis on surface stone removal (common variety minerals). Soil impacts are not expected to increase greatly for any of the alternatives because most gas wells will occupy small areas, pipelines will be mostly located in road ROWs, and common variety minerals will be carefully managed.

Overall soil impacts from recreation, grazing, and minerals activities are expected to be minor for all of the alternatives. Most of the soil impacts of all alternatives are expected to be short-lived. Most of the soil disturbance in harvested areas occurs on temporary roads, primary skid trails, and log landings. Temporary roads, primary skid trails, and log landings will be disked, seeded, and fertilized to speed the recovery of

soil productivity after they are no longer needed. Fire lines will be water-barred, fertilized, and seeded where needed to speed the recovery of soil productivity.

Alternative A

The main soil impacts will be due to road construction, timber harvesting, and prescribed burning. Approximately 14,362 acres on the Ozark NF are expected to sustain soil impacts due to timber harvesting during the first decade. No harvest is planned for the St. Francis NF during the first decade. Approximately 23 acres of soil due to permanent road construction and 233 acres of soil due to temporary road construction of soil are expected to be taken out of production during the first decade. Additionally, 31 acres are estimated to sustain a temporary loss in soil productivity due to fire line construction.

The amount of existing road miles decommissioned is expected to equal the miles of new road constructed for this alternative. Therefore, the decommissioning of existing roads will compensate for the amount of soil taken out of production due to construction of new permanent roads and the acres of soil dedicated to permanent roads will remain the same. Overall, this alternative is expected to have next to the lowest soil impacts when compared to the other alternatives.

Alternative B

The main soil impacts will be due to road construction, timber harvesting, and prescribed burning. Approximately 11,931 acres on the Ozark NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 542 acres on the St. Francis NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 19 acres and 190 acres of soil are expected to be taken out of production due to permanent road and temporary road construction respectively during the first decade. Additionally, 35 acres are estimated to sustain a temporary loss in soil productivity due to fire line construction.

The amount of existing road miles decommissioned is expected to exceed the miles of new road constructed for this alternative. Therefore, the amount of soil dedicated to permanent roads is expected to decline because more miles of road will be decommissioned than constructed. Overall, this alternative is expected to have the lowest amount of soil impacts when compared to the other alternatives.

Alternative C

The main soil impacts will be due to road construction, timber harvesting, and prescribed burning. Approximately 15,043 acres on the Ozark NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 884 acres on the St. Francis NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 22 acres and 223 acres of soil are expected to be taken out of production due to permanent road and temporary road construction, respectively, during the first decade. Additionally, 65 acres are estimated to sustain a temporary loss in soil productivity due to fire line construction.

The amount of existing road miles decommissioned is expected to exceed the miles of new road constructed for this alternative. Therefore, the amount of soil dedicated to permanent roads is expected to decline because more miles of road will be decommissioned than constructed. Overall, this alternative is expected to have the highest soil impacts when compared to the other alternatives.

Alternative D

The main soil impacts will be due to road construction, timber harvesting, and prescribed burning. Approximately 14,105 acres on the Ozark NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 542 acres on the St. Francis NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 24 acres and 240 acres of soil are expected to be taken out of production due to permanent road and temporary road construction, respectively, during the first decade. Additionally, 39 acres are estimated to sustain a temporary loss in soil productivity due to fire line construction.

The amount of existing road miles decommissioned is expected to equal the miles of new road construction for this alternative. Therefore, the amount of soil taken out of production due to construction of new permanent roads will be compensated by the decommissioning of existing roads and the acres of soil dedicated to permanent roads will remain the same. Overall, this alternative is ranked midway between the other alternatives with respect to soil impacts.

Alternative E

The main soil impacts will be due to road construction, timber harvesting, and prescribed burning. Approximately 13,599 acres on the Ozark NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 937 acres on the St. Francis NF are expected to sustain soil impacts due to timber harvesting during the first decade. Approximately 21 acres and 210 acres of soil are expected to be taken out of production due to permanent road and temporary road construction, respectively, during the first decade. Additionally, 52 acres are estimated to sustain a temporary loss in soil productivity due to fire line construction.

The amount of existing road miles decommissioned is expected to exceed the miles of new road constructed for this alternative. Therefore, the amount of soil dedicated to permanent roads is expected to decline because more miles of road will be decommissioned than constructed. Overall, this alternative is expected to have next to the lowest amount of soil impacts during the first decade when compared to the other alternatives.

Cumulative Effects

The forest management activities with the greatest long-term potential to impact soils are associated with road and trail construction, timber harvesting and associated operations, and construction of control lines for fire management. Management

standards (mitigation measures) presented in forest-wide standards, Chapter 2 of the Draft Forest Plan can conserve long-term soil productivity.

In the short term, the alternatives disturbing the greater area of soils will potentially generate the larger short-term reduction in productivity. In ascending order, from least to greatest potential within the first decade would be Alternatives B, E, D, A and C on the Ozark NF. In ascending order, from least to greatest potential within the first decade would be Alternatives A, B, D, C, and E on the St. Francis NF. However, with implementation of prescribed management measures (i.e., revegetation and protection of bare soil areas), the long-term cumulative effects from management impacts can be kept within Region 8 Soil Quality Standards.

Cumulatively, environmental consequences to soils from past, present and foreseeable actions associated with use and management of different kinds of soils on the Forests can be made minimal through careful planning and use of appropriate measures (Forest LRMP Standards and Arkansas' Best Management Practices).

WATERSHEDS, STREAMS, AND WATER RESOURCES

Watershed

Affected Environment

Lands administered by the OSFNFs are located within 10 major sub-basins in northwest and north-central Arkansas, and 4 sub-basins of the Mississippi Delta Region in eastern Arkansas. Furthermore, these lands are distributed across 50 watersheds (5^{th} level Hydrologic Units) with the majority of the land centered on the main division north of Russellville, Arkansas. Figure 3-1 depicts the spatial distribution of the OSFNF lands with respect to these watershed boundaries and Figure 3-2 assigns each watershed with a number from 1 to 51. Table 3-4 lists the hydrologic unit code (HUC), name, corresponding number, acres of FS land present, FS district, and state ecoregion for the watersheds.

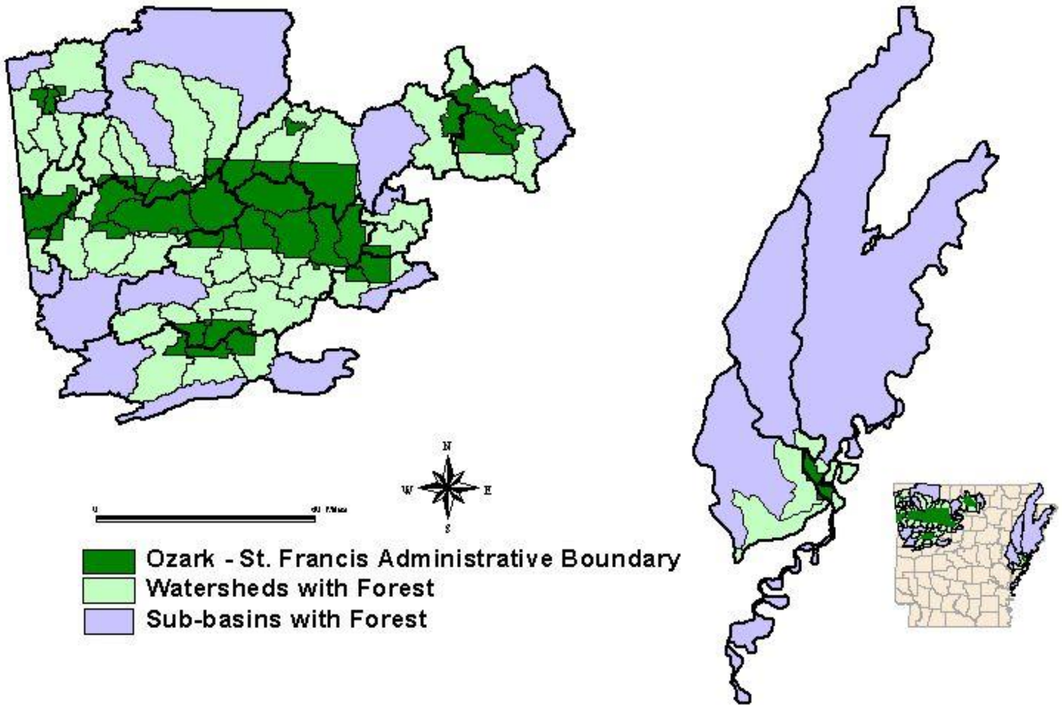

Figure 3-1: OSFNFs Boundary and the 5th Level Watersheds.

Table 3-4: Ozark-St. Francis National Forest Watersheds.

Hydrologic Unit Code	Unit Name (Numbers Refer to Figure 3-2)	Administrative Sub-Basin/ Watershed (approximate acres)	District Number	ADEQ Ecoregion
08	Lower Mississippi			
0802	Lower Mississippi-St. Francis			
080201	Lower Mississippi-Helena			
08020100	Lower Mississippi-Helena	7,870		
0802010002	Mississippi River (1)	7,870	7	DL
080202	St. Francis			
08020203	Lower St. Francis	15,940		
0802020334	Phillips Bayou (2)	15,940	7	DL
08020205	L'Anguille	286		
0802020513	L'Anguille River (3)	286	7	DL
080203	Lower White			
08020304	Big	5,716		
0802030404	Lick Creek (4)	5,378	7	DL
0802030405	Beaver Bayou Ditch (5)	338		DL
11	Arkansas-White-Red			
1101	Upper White			
110100	Upper White			

Districts: 1-Sylamore, 2-Buffalo, 3-Bayou, 4-Pleasant Hill, 5-Boston Mt., 6-Magazine, 7-St. Francis
ADEQ Ecoregions: BM-Boston Mountains, OH-Ozark Highlands, AV-Arkansas River Valley, DL-Delta

Table 3-4: Ozark-St. Francis National Forest Watersheds. (Continued)

Hydrologic Unit Code	Unit Name Numbers Refer to Figure 3-2	Administrative Sub-Basin/ Watershed (approximate acres)	District Number	ADEQ Ecoregion
11010001	Beaver Reservoir	7,6915		
1101000101	Upper White River (6)	3,6099	4,5	BM
1101000102	White River (7)	13412	5	BM
1101000103	Mid. Fork White River (8)	7098	5	BM
1101000104	W. Fork White River (9)	5150	5	BM
1101000106	War Eagle Creek (10)	1288	2,4	OH/BM
1101000109	Kings River (11)	13868	2	OH/BM
11010004	Middle White	143410		
1101000401	Barren Creek (12)	52508	1	OH
1101000403	Rocky Bayou (13)	18581	1	OH
1101000404	N. Sylamore Creek (14)	72321	1	OH
11010005	Buffalo	235042		
1101000501	Buffalo River (15)	38990	2	BM
1101000502	Little Buffalo River (16)	42865	2	BM
1101000503	Richland Creek (17)	120524	2,3	OH/BM
1101000505	Big Creek (18)	32663	1	OH
11010014	Little Red	14529		
1101001403	S. Fork of Little Red River (19)	14103	3	BM
1101001404	Archey Creek (20)	426	3	BM
1111	Lower Arkansas			
111101	Robert S. Kerr Reservoir			
11110103	Illinois	28481		
1111010301	Illinois River (21)	12741	5	OH/BM
1111010303 1111010304	Osage Creek (22) Muddy Fork (23)	3059 484	5 5	OH OH/BM
1111010306	Wedington Creek (24)	11223	5	OH
1111010307	Baron Fork (25)	974	5	OH/BM
11110104	Robert S. Kerr Reservoir	83343		
1111010404 1111010405	Cove Creek (26) Webber Creek (27)	74110 9233	5 5	BM BM
111102	Lower Arkansas-Fourche La Fave			
11110201	Frog-Mulberry	315048		
1111020104	Up. Frog Bayou (28)	56793	5	BM
1111020105	Frog Bayou (29)	12983	5	BM
1111020106	Up. Mulberry River (30)	103072	4	BM
1111020107	Mulberry River (31)	119958	4,5	BM
1111020108	Little Mulberry Creek (32)	19372	5	BM
1111020109	White Oak Creek (33)	2870	4	BM

Districts: 1-Sylamore, 2-Buffalo, 3-Bayou, 4-Pleasant Hill, 5-Boston Mt., 6-Magazine, 7-St. Francis
ADEQ Ecoregions: BM-Boston Mountains, OH-Ozark Highlands, AV-Arkansas River Valley, DL-Delta

Table 3-4: Ozark-St. Francis National Forest Watersheds. (Continued)

Hydrologic Unit Code	Unit Name Numbers Refer to Figure 3-2	Administrative Sub-basin/ Watershed (approximate acres)	District Number	ADEQ Ecoregion
11110202	Dardanelle Reservoir	490556		
1111020204	Short Mountain Creek (35)	23246	6	AV
1111020205	Spadra Creek (36)	17247	4	BM/AV
1111020206	Horsehead Creek (37)	23721	4	BM/AV
1111020207	Cane Creek (38)	1952	6	AV
1111020208	Little Piney Creek (39)	60746	4,3	BM/AV
1111020209	Up. Big Piney Creek (40)	98704	2	BM
1111020210	Big Shoal Creek (41)	39320	6	AV
1111020211	Big Piney Creek (42)	88333	2,3	BM
1111020212	N. Fork Illinois Bayou (43)	71666	3	BM
1111020213	Mid. Fork Illinois Bayou (44)	61667	3	BM
1111020214	Illinois Bayou (45)	2851	3	AV
1111020215	Arkansas River (46)	901	6	AV
11110203	Lake Conway-Point Remove	48376		
1111020305	Hackers Creek (47)	12943	3	BM
1111020306	Brock Creek (48)	35433	3	BM
11110204	Petit Jean	63523		
1111020402	Revilee Creek (49)	15105	6	AV
1111020403	Cedar Creek (50)	20755	6	AV
1111020404	Chickalah Creek (51)	27663	6	AV

Districts: 1-Sylamore, 2-Buffalo, 3-Bayou, 4-Pleasant Hill, 5-Boston Mt., 6-Magazine, 7-St. Francis
ADEQ Ecoregions: BM-Boston Mountains, OH-Ozark Highlands, AV-Arkansas River Valley, DL-Delta

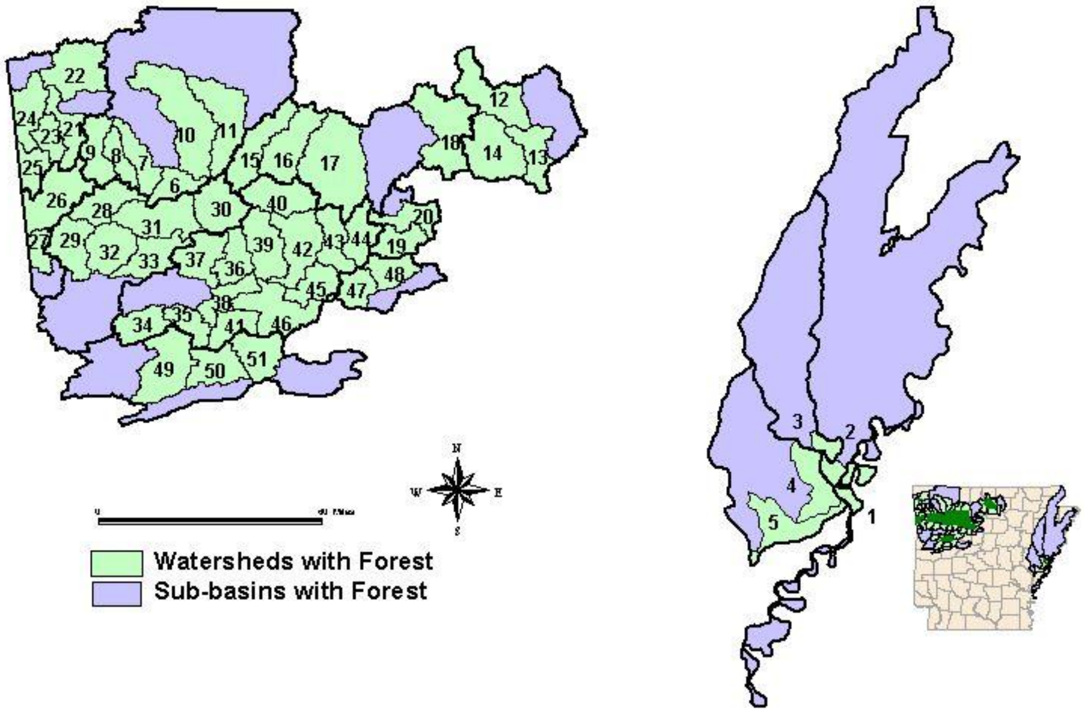

Figure 3-2: Watersheds with Labels (see Table 3-4).

Water Quality

The Arkansas Department of Environmental Quality (ADEQ) has divided the state into ecoregions for use in assessing water quality in accordance with Section 305(b) of the Clean Water Act (CWA). The waters of Arkansas have distinguishing physical, chemical, and biological characteristics as defined by their ecoregion (ADEQ, 2004). Watersheds within the OSFNFs occur in the Delta, Arkansas River Valley, Boston Mountain, and Ozark Highlands Ecoregions. A general summary of water quality by ecoregion is displayed in Figure 3-3.

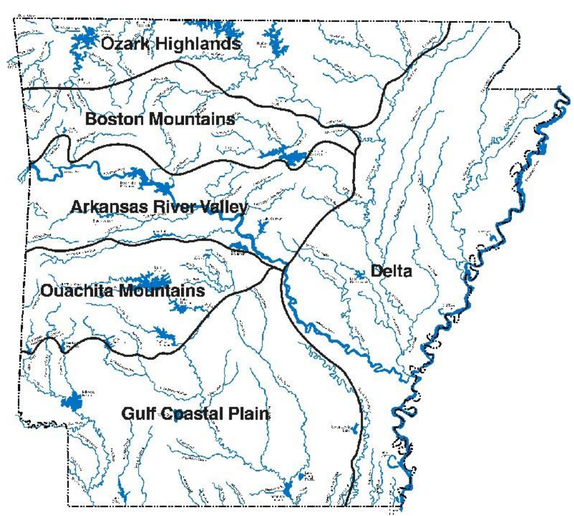

Figure 3-3: ADEQ State Ecoregions for Water Quality Purposes.

The Delta Ecoregion occupies the eastern third of Arkansas. It is comprised of alluvial sand, gravel, and clay deposited by the larger rivers and some wind-deposited loess. The Delta is the state's flattest ecoregion with reliefs of only a few feet per mile. As a result, natural streams of this region are sluggish and meandering with very little gradient and low aeration rates. Stream bottoms are usually silt or clay (APCEC, 1987).

Water quality in the Delta Ecoregion is significantly influenced by non-point source runoff from the predominately agricultural use of the areas. The vast majority of the waterways within this region form a network of extensively channelized drainage ditches. Long-term government programs have been used to develop this highly productive agricultural land. In contrast, many of the practices utilized in making this land more productive actually impair the designated water quality uses. Recent work within this region indicates that in the majority of these waters, the best fishery that can be expected is an altered fishery. Once a natural stream has been channelized, only organisms that do not require in-stream cover and can exist in highly turbid (muddy) waters will survive. The fishable goal of the CWA is being met within these systems even though the aquatic life communities have been substantially altered. Many of the waterways within the Delta Ecoregion do not consistently maintain the swimmable criteria set forth within the Arkansas water quality standards (ADEQ 2002).

The St. Francis NF is located in the Delta Ecoregion and supports two distinct Land types: Mississippi Bottomlands and Crowley's Ridge. The Mississippi Bottomlands have many of the characteristics of the Delta. Abandoned stream channels, natural levees, and back swamp areas are common. The lowest flows for this area are found during the fall after high summer temperatures have decreased slightly. The Crowley's Ridge land type is expressed by relief as much as 300 feet above the adjacent delta plains and can range from 1 to 4 miles in width. This landform was developed by loess deposits and is characterized by steep ridges with narrow, winding valleys between ridges. Stream flow is highest during the winter and spring due to large precipitation during this interval. Streams capable of supporting a fishery are limited due to the small watersheds supplying these streams. However, these streams do feed the recreational lakes on the district. Most of the St. Francis NF streams originate on public lands and have not been altered to the same degree as those across the rest of the ecoregion. They provide a good example of the least-altered Delta ecoregion fishery resource.

The Arkansas River Valley Ecoregion is found in the central portion of the state between the Boston Mountains and the Ouachita Mountains. Moderately folded, Pennsylvanian age shales and sandstones of the Hartshorne and Atoka formations underlie this region. Quaternary aged alluvial deposits are found on the flood plains of the Arkansas River. The general topography is rolling, but synclinal mountains and mesas produce some of the greatest relief in the state. Streams in the Arkansas River Valley vary from slow, meandering streams following the major valleys to pool and riffle complexes in the smaller watersheds of the region. Stream bottoms can consist of silt, gravel, shale, rubble, or solid bedrock. Many streams exhibit a light brown turbidity as a result of this underlying geology (APCEC 1987).

The Arkansas River Valley Ecoregion exhibits distinct seasonal characteristics of its surface waters with zero flows common during the summer critical conditions. Peak runoff events within this region tend to introduce contaminants from the predominantly agricultural land use, which are primarily pastures with increasing hog, poultry, and dairy production. Fecal coliform is the parameter of concern due to its preclusion of the swimmable use. Measurements during storm events routinely exceed the water quality standard, although the source is not human fecal contamination. Most recently, this area has experienced rapid expansion of confined animal activities. The current exploitation of natural gas deposits has resulted in some site-specific water quality degradation. Soil types in much of this area are highly erosive and tend to easily go into colloidal suspension, thus causing long-lasting, high turbidity values (ADEQ 2002).

The Boston Mountain Ecoregion lies north of the Arkansas River Valley and extends from central Arkansas to the Oklahoma state line. This landform was produced during a regional uplift in conjunction with the Ozark Plateau and is the highest and most eroded portion of this physiographic feature. Pennsylvanian aged sandstones and shales underlie this landform and thick, resistant horizons form bluffs that tower over the valley floor near the tops of these mountains. Steep side slopes and 1,000-foot local relief create an exceptionally rugged terrain. In this region, runoff can be rapid and streams have a very flashy characteristic. This promotes seasonal scouring of the larger river channels. The pool-and-riffle type streams have a combination of bottom types, which can consist of sand, gravel, rubble, boulders, or bedrock. Rubble tends to be rounded and collects in the riffles that cause the stream to seem to disappear at low flow (APCEC 1987).

The Boston Mountain Ecoregion, located in north central Arkansas, is a sparsely populated area. The dominant land use is silviculture and much of the region is located within the OSFNFs. It is a high-use recreational region with exceptionally high quality water. A large percentage of the streams from this region are designated as extraordinary resources. Major concerns about potential water quality degradation include expansion of confined animal operations, wide-spread land conversion to non-forest uses, activities that result in non-point source pollution without proper implementation of Arkansas' BMPs, and localized natural gas production. Long-term monitoring of this region by the ADEQ continues to reflect high water qualities. Clearing timberland for conversion to pastures adjacent to major streams is the main cause of periodic elevated levels of turbidity in some waters of this region. This accelerates stream channel and bank erosion. In addition, second- and third-level road construction and maintenance as well as in-stream gravel removal aggravate turbidity problems (ADEQ 2002).

The Ozark Highlands Ecoregion is physiographically made up of the Salem Plateau and the Springfield Plateau in northwestern and north central Arkansas. The surface rocks are mainly carbonaceous limestones and dolomites. Weathering this bedrock exposes fragments of insoluble chert that cover the ground and are very common in the streams of this region. This Ozark region was uplifted as a whole unit with little folding forming a plateau-like landform, which has been deeply incised by streams and rivers. In some instances, local relief is as much as 1,000 feet. The streams of

this region are composed of pools and riffles with bedrock, chert rubble, and gravel substrates with moderate to high gradients. There are numerous springs, sinks, and other karst features in the area, and streams can gain or lose considerable portions of flow via these underground drainage features. These streams typically have very low turbidities and have remarkable recreational value (APCEC 1987).

The Ozark Highlands Ecoregion, located in extreme north Arkansas, is noted for its mountainous terrain with steep gradients and fast-flowing, spring-fed streams. A large percentage of the streams from within this region are designated as extraordinary resource waters. The fractured and cavernous limestone geology of the region allows a direct linkage from surface waters to groundwater. The water quality problems within this region are directly related to land use. Some of the highest animal (chickens, swine, cattle) production rates in the United States are found in this region. The waste generated from these animal production facilities is generally land applied and, therefore, has the potential for contaminating both surface and groundwater. The nitrate levels measured from this region are atypically high and are trending upward. The large human populations increase in this area results in increased water contamination from infrastructure development as well as human waste generation. Removal of gravel from the banks and beds of streams is a very frequent activity (ADEQ 2002).

Designated Uses

There are approximately 170 miles of designated wild and scenic rivers on the OSFNFs. These are perhaps the highest quality large streams found within the forest boundaries or the state. These waters are selected by the state to receive the Outstanding Resource Water classification. By virtue of their designation, the state has set particular water quality standards for these waters. These rivers are given unique consideration by the Forest Service with regard to management through the Wild and Scenic River management area prescription. Arkansas Pollution Control and Ecology Commission's (APCEC) Regulation 2 states that:

> "Where high quality waters constitute a national resource, such as those waters designated as natural and scenic waterways, those uses and water quality for which the outstanding waterbody was designated shall be protected by (1) water quality controls, (2) maintenance of natural flow regime, (3) protection of instream habitat, and (4) encouragement of land management practices protective of the watershed" (APCEC 2004).

Water quality is typically very good when the source area for streams and reservoirs are National Forest lands. These water bodies generally meet or exceed all water quality criteria established by the State of Arkansas for their uses classification. Reaches of some streams might not meet specific criteria such as siltation or fecal coliform, particularly during storm events, due to the presence of interspersed private land in-holdings where the land use has been dramatically altered from forested conditions, or Arkansas' BMPs for the land-use activities are not properly applied. Water quality concerns can result from natural events such as floods and landslides,

uses associated with land management other than forested, oil and gas removal operations, and inappropriate silviculture activities.

The primary water quality concerns related to National Forest management activities are sedimentation, siltation, and turbidity. Transportation systems (roads) are acknowledged as being the primary non-point source sediment production source, although timber harvest practices, prescribed burning, developed recreation, and dispersed recreation activities can also result in non-point source pollution. Of the 50 watersheds considered for the planning effort, four were found to have surface waters on the State 303d list as non-supportive of designated uses. These are listed in Table 3-5 and shown in Figure 3-4.

Table 3-5: Water Quality Limited Water Bodies (State 303d) within Similar Watersheds as Forest Service Administrative Boundaries.

River or Stream	Hydrologic Unit Code	Designated Use Not Supported	Source	Cause
Holman Creek	1101000106	Drinking Water	Municipal Point Source	Nitrate Nitrogen
Hicks Creek	1101000401	Drinking Water	Municipal Point Source	Nitrate Nitrogen
West Fork Creek	1101000104	Aquatic Life	Road Construction/ Agriculture	Siltation/Turbidity
L'Anguille River	0802020513	Aquatic Life	Agriculture	Siltation/Turbidity

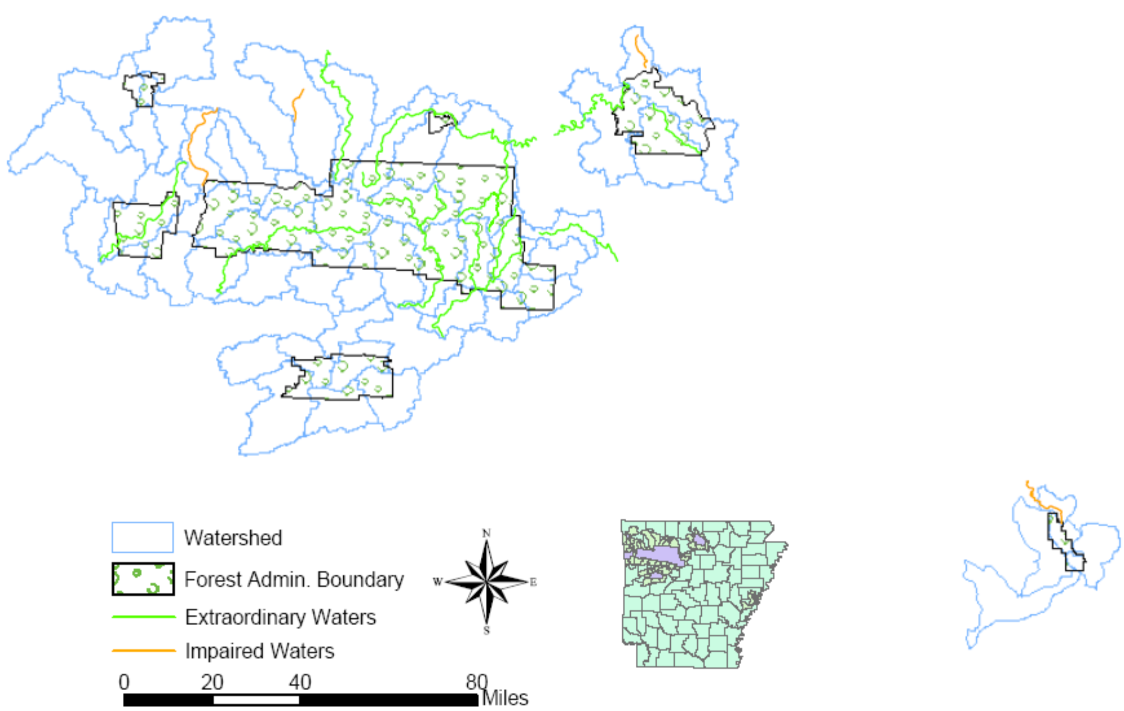

Figure 3-4: Extraordinary and Impaired Waters within Similar Watersheds as Forest Service Administrative Boundaries.

Surface Water Yield and Runoff

Runoff is water that drains from the land into streams or river channels after precipitation. Runoff volume is a function of precipitation, topography, geology, soil moisture, land use, and other factors. Mean annual runoff can be computed by dividing the mean annual volume of water leaving a basin (as measured by gauging stations) by the area of the basin. Mean annual runoff from areas encompassing the OSFNFs varies from 14 to 20 inches per year (USGS 1987).

Assuming an average surface runoff for the Forests is 17 inches per year (1.4 feet) across the forest administrative boundary (1,530,000 acres), the forest area yields approximately 2,142,000 acre-feet of water per year (600 billion gallons). This amount is distributed spatially among the various watersheds throughout the year.

For most areas of the Arkansas Valley and Boston Mountain Ecoregions, especially the areas on the OSFNFs, the sustained base flow from streams and rivers can be very low, even non-existent at times (AGC 1975). This is the result of a number of landscape characteristics present in these ecoregions, the two most important being the topographic relief and the geologic setting. Steep terrain and high stream gradients within small mountainous watersheds do not support large rates of infiltration, which would be the precursor for sustained base flows during dry seasonal cycles. The geology of this area, mainly compacted and cemented Paleozoic sedimentary formations, is not found to support high primary porosities. This is a necessary characteristic for long-term storage of groundwater and subsequent supply to local streams.

These and other physiographic characteristics produce streams with an immediate, or flashy, response to individual precipitation events and highly seasonal flow yields in response to normal climatic variations. Figure 3-5 shows the annual average precipitation runoff across the OSFNFs. Table 3-6 displays the average annual water from precipitation compared to withdrawals and consumptive uses for sub-basins across the Ozark NF during 1995, and Table 3-7 refers to the water use per county in the OSFNFs.

Table 3-6: Average Annual Water Availability (from Precipitation) Compared with Withdrawals and Consumptive Uses for Sub-basins across the Ozark NF during 1995 (OOHA 1999).

Hydrologic Unit Code	Sub-basin	Water Availability from Precipitation	Yield	Withdrawal		Consumptive Use	
		*Mgal/d			% of Yield	Mgal/d	% of Yield
11010001	Beaver Reservoir	5379	2261	29	1.3	12.9	0.6
11010004	Middle White	3269	979	28	2.9	14.8	1.5
11010005	Buffalo	2867	1130	2	0.2	1.5	0.1
11010014	Little Red	4149	1420	46	3.2	27.8	2
11110103	Illinois	3424	1350	381	28.2	14.4	1.1
11110104	Robert S. Kerr Reservoir	3741	1269	54	4.2	15.9	1.3
11110201	Frog-Mulberry	2753	1056	23	2.2	6.9	0.7
11110202	Dardanelle Reservoir	4047	1381	1017	73.6	8.5	0.6
11110203	Lake Conway-Point Remove	2585	811	29	3.5	9.9	1.2
11110204	Petit Jean	2337	764	8	1	8	0.5

***Thousand Gallons per Day.**

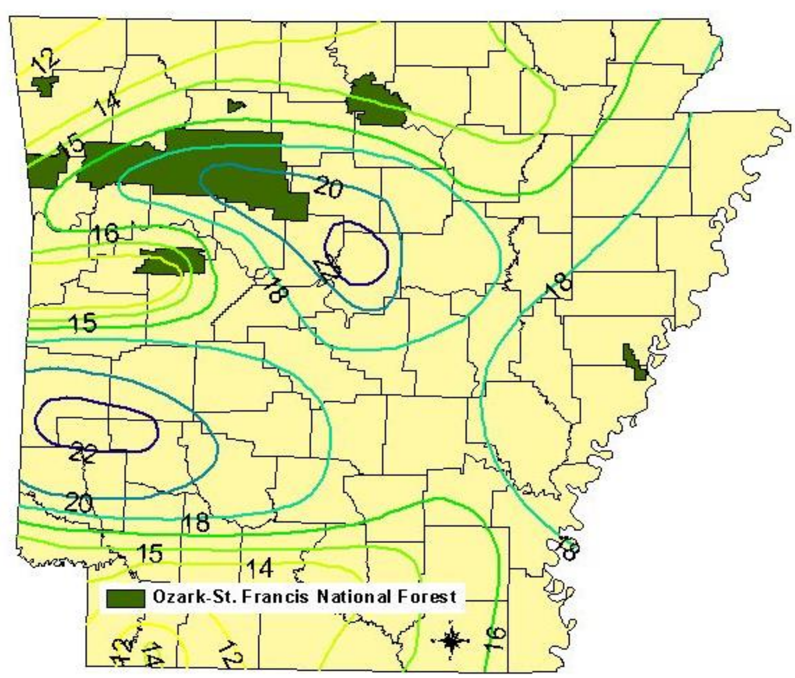

Figure 3-5: Average Annual Precipitation Runoff (inches).

Table 3-7: Water Use per County in the Ozark NF for 1995 (OOHA 1999).

Values Reported in *Mgal/day	Domestic and Public	Commercial	Industrial	Off-Stream, Thermo-electric	Livestock	Crop Irrigation	Total	Hydro-electric
Baxter	2.73	1.23	1.23	0	0.34	0	6	999
Benton	11.77	0.94	0.94	319.27	2.92	0.45	336	0
Conway	1.55	0.16	20.66	0	1.6	4.55	29	0
Crawford	12.33	1.22	1.66	0	0.62	0.06	16	0
Franklin	2.64	0.4	0.32	8.23	0.89	0.08	13	15018
Johnson	2.14	0.61	0.53	0	0.64	0.31	4	0
Logan	2.75	0.37	0.36	0	1.07	0.37	5	0
Madison	1.62	0.37	0.36	0	1.3	0	4	0
Marion	1.07	0.11	0.1	0	0.46	0	2	4718
Newton	0.63	0.01	0	0	0.33	0.06	1	0
Pope	5.66	34.99	2.53	967.12	0.92	1.22	1012	8948
Searcy	1.06	0.08	0.08	0	0.54	0	2	0
Stone	0.91	0.19	0.18	0	0.52	0	2	0
Van Buren	1.92	0.02	0.02	0	0.56	0	3	0
Washington	13.96	5.36	5.33	0	2.6	0.12	27	0
Yell	3.55	2.99	0.31	0	1.02	1.83	10	0

***Thousand Gallons per Day**

Groundwater

Arkansas groundwater resources are distinctly divided physiographically into two parts: the Gulf Coastal Plain and the Interior Highlands.

The Gulf Coastal Plain occurs across eastern and southeastern Arkansas and corresponds with the Delta and Coastal Plain Ecoregions. The St. Francis NF is located in this setting. Within this region, the alluvial aquifer is extremely plentiful and widely used for irrigation purposes. Deeper aquifer systems are experiencing general declines in groundwater levels because water withdrawals are exceeding recharge potentials.

The Interior Highlands encompass 31,000 square miles across the northwestern half of the State in which the land units comprising the Ozark NF are located. The thick, consolidated, Paleozoic-aged geologic sequences lie under this area and have been extensively folded, faulted, compacted, and cemented. This has resulted in reduced values for primary porosity storage. Groundwater occurs primarily in fractures and joints of the sandstones and shales, and in the solution openings of limestones and dolomites. These sources provide local water supply for thousands of rural homes across the regions. Wells average 200 to 800 feet in depth beneath areas within the forest service administrative boundary and generally yield less than 10 gallons per

minute (gpm). Yields greater than 25 gpm are rare. An exception to this generality is the Roubidoux and Van Buren Formations of extreme Northwest Arkansas and the Arkansas River Alluvium (USGS 1985).

Source Water Assessment Programs–Public Water Supplies

The Source Water Assessment Program (SWAP) for the state of Arkansas is a result of the 1996 amendments to the Safe Drinking Water Act. This program was under management by the Arkansas Department of Health–Division of Engineering. The purpose of this program was to identify and describe public water supply source areas across the State and provide a consistent framework for analyzing the vulnerability of these source areas to contamination. The Environmental Protection Agency (EPA) no longer funds this program, but local water suppliers, third-party agencies, and co-operatives are using this information to secure the water sources from catastrophic and chronic contamination.

There are 44 public water supplies located within the OSFNFs' administrative boundary. Thirteen of these are forest service related, and most of these are public supply wells located at developed recreation sites. Of the 44 sources, 2 are lake intakes, 2 are river intakes, 1 is a spring source, and 39 are groundwater wells (7 wells are surface water influenced). These public water supply sources have assessment areas described by the SWAP that intersect 442,202 acres within the administrative boundary of the OSFNFs.

Watershed Assessment

A general assessment of watershed conditions and vulnerability was recently completed on the Forests. This process utilized the East-Wide Watershed Assessment Protocol (EWAP) for forest plan amendment, revision, and implementation. This process comparatively ranked each of the 50 fifth (5^{th}) level watersheds that occur on the Forests in terms of their condition and vulnerability. The rating considered public as well as private land within the watersheds. In general, the watersheds that ranked poorest in condition have a low percentage of National Forest land, a relatively high percentage of urban/agricultural land use, and a higher number of point sources. The watersheds that ranked highest in vulnerability to impact were those that included impaired waters, source water areas, large population densities, and large areas of non-forested riparian corridors. The Upper Mulberry, Upper Big Piney, North Fork, and Middle Fork of the Illinois Bayou were watersheds found to have the best relative conditions. The Arkansas River, Spadra Creek, and Osage Creek watersheds were found to have the least favorable watershed conditions.

Current Conditions

A sediment model (Clingenpeel, 2004) has been utilized to estimate the existing conditions regarding sediment yield within the 5^{th} level watersheds that contain National Forest lands. Table 3-8 displays each watershed's total size, area in the administrative boundary, area of public ownership, sediment yield, and the increase

over a modeled “pristine” condition. The yields depicted in the table result from the combination of public and private lands and land uses across the watershed’s area.

To estimate the current sediment budget a landscape-based model developed by the FS personnel was utilized. Many of the assumptions for this modeling process are detailed in the cumulative effects section and in a report developed for the planning files. For the following resource depiction, each watershed had a "pristine" condition sediment budget and a current condition sediment budget where a comparison between these two was made. The "pristine" condition only accounted for a landscape where the only land use was forested and erosion was a function of slope and ecoregion. For current condition sediment budgets, land use varied and erosion was a function of roads, land use practices, slope, and ecoregion. The comparison between these two conditions is described by the increase (as a percent) in the sediment budget for the current condition over the sediment budget estimated for the "pristine" condition. These comparison values (percent increase) are large numbers because of large disparities between measured values of erosion for developed land and roads as compared to forested land uses.

Table 3-8: Current Sediment Yield by Watershed, including Acres of FS Land Base.

Hydrologic Unit Code	Total Acres	FS Administrative Area (Acres)	Public Land (Acres)	Percent (%) of Public Land	Current Estimated Sediment Budget (Tons)	Percent (%) Increase Over Natural	Tons per Square Mile
0802010002	67654	7869	7278	10.8	16900	2396	160
0802020334	25682	15940	11777	45.9	17651	3771	440
0802020513	25079	286	144	0.6	52477	15180	1339
0802030404	89286	5378	1731	1.9	139442	16942	999
0802030405	108613	338	305	0.3	145683	15928	885
1101000101	57389	36099	24500	42.7	3700	168	41
1101000102	69880	13412	8321	11.9	6182	424	57
1101000103	48243	7098	2621	5.4	5580	456	74
1101000104	79566	5150	68	0.1	13162	1369	106
1101000106	213636	1288	584	0.3	16242	886	49
1101000109	141634	13868	7347	5.2	10078	506	46
1101000401	131812	52508	28436	21.6	8327	445	40
1101000403	81581	18581	15906	19.5	4463	202	35
1101000404	140401	72321	62488	44.5	7670	200	35
1101000501	111116	38990	31916	28.7	6367	167	37
1101000502	120586	42865	23429	19.4	6876	200	37
1101000503	237071	120523	95616	40.3	9698	181	26
1101000505	172115	32663	25360	14.7	8907	194	33
1101001403	62007	14103	11955	19.3	2548	160	26
1101001404	64709	426	388	0.6	3844	186	38

Table 3-8: Current Sediment Yield by Watershed, including Acres of FS Land Base. (Continued)

Hydrologic Unit Code	Total Acres	FS Administrative Area (Acres)	Public Land (Acres)	Percent (%) of Public Land	Current Estimated Sediment Budget (Tons)	Percent (%) Increase Over Natural	Tons per Square Mile
1111010301	72140	12741	6608	9.2	15222	2186	135
1111010303	132067	3059	1290	1.0	35541	4177	172
1111010304	46901	484	251	0.5	12539	2611	171
1111010306	134855	11223	7109	5.3	19055	1727	90
1111010307	221244	974	792	0.4	19750	1095	57
1111010404	158251	74110	44270	28.0	6180	270	25
1111010405	137909	9233	3684	2.7	7191	543	33
1111020104	81538	56793	29632	36.3	5062	186	40
1111020105	91557	12983	5649	6.2	12707	1078	89
1111020106	104998	103072	76237	72.6	4393	135	27
1111020107	127445	119958	104883	82.3	5303	145	27
1111020108	93859	19372	12851	13.7	18699	1579	128
1111020109	91513	2870	1923	2.1	9276	906	65
1111020204	52747	23246	17062	32.3	4963	554	60
1111020205	67002	17247	9537	14.2	6860	554	66
1111020206	87477	23721	13626	15.6	8172	529	60
1111020207	60453	1952	1621	2.7	6508	1148	69
1111020208	103242	60746	46448	45.0	5520	210	34
1111020209	98704	98704	81061	82.1	4750	129	31
1111020210	62126	39320	33827	54.4	2388	245	25
1111020211	120002	88333	84978	70.8	5068	148	27
1111020212	75869	71666	65205	85.9	3096	137	26
1111020213	72473	61667	55899	77.1	3171	143	28
1111020214	69788	2851	5006	7.2	5448	644	50
1111020215	126996	901	882	0.7	8554	783	43
1111020305	55951	12943	7744	13.8	4399	514	50
1111020306	59740	35433	27419	45.9	2284	287	24
1111020402	142607	15105	10351	7.3	5387	295	24
1111020403	84138	20755	13207	15.7	8212	579	63
1111020404	86525	27663	23600	27.3	5522	476	41

Direct and Indirect Effects

Resource management has the potential to result in both direct and indirect effects on water resources the OSFNFs. Direct effects are those that occur at the same time and place as the action (40 CFR 1508.8). Indirect effects are caused by an action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). These effects can range from beneficial products to adverse outcomes, and operate at different magnitudes across multiple scales of

time and space. Intensive changes to vegetation structure and composition, conversion of forestland to agriculture or urban uses, and extensive soil exposure are the key threats to the water resources of the Forests. Natural processes, Forest Service activities, and private land uses all contribute to these to water quality within a watershed.

The following activities and uses have the potential to affect water resources:

- **Vegetation Management:** Vegetation management primarily results in soil disturbance by removing trees from the woods. Harvesting practices require skid trials, temporary roads, permanent roads, and log landings. These practices increase the potential for erosion. Changes to water and sediment yields are an indirect effect of this activity (Ursic and Douglas 1978).
- **Recreation (Dispersed and Developed):** Water plays an important role in many aspects of recreation on the Forests. The need and desire for developed and dispersed recreational users to be near water create varying degrees of impact to the streams and rivers of the OSFNFs.
- **Fire Management:** Each alternative proposes prescribed burning for fuel reduction, ecosystem restoration, and site preparation. The effects of prescribed fire vary depending on fire severity, type, fuel characteristics, soil moisture, and recurrence interval.
- **Transportation and Access:** Watershed effects related to roads are generally categorized as geomorphic effects (accelerated erosion) and hydrologic modification.
- **Mineral Management:** A limited amount of mineral activity occurs on the Forests and this trend is not expected to change dramatically over the next planning period.
- **Off-stream Uses:** Population growth of rural areas in northern Arkansas may eventually require the use of surface water as a drinking water supply because of the limited ground water resources.
- **Point Source Discharges:** Across the OSFNFs, there is a much lower concentration of regulated point source discharges compared to the rest of the state. The activities and uses associated with this plan will not require point source discharges by national forest facilities.

Vegetation Management

Experiments in the Ozark Highlands and Boston Mountain Regions of Arkansas found that silviculture practices within small watersheds result in a temporary increase in sediment yields (Lawson 1986). Absolute losses were found to be less than those of well-managed eastern forests (Patric, 1976). Sediment yields from timber harvesting activities in Arkansas return to natural levels 3 to 4 years following these activities (Ursic 1986). Three factors (minimal susceptibility of soils to erosion, large amounts of rock fragments, and rapid vegetation reestablishment) are all factors that limit excessive erosion values.

Ground disturbance can result in erosion and increased risk of excessive sediment delivery to streams. This occurs when ground disturbance combines with runoff

generating rainfall event. Naturally-occurring landslides or stream bank failures are often found to dominate sediment budgets as compared to the contributions from sheet or rill erosion in small to medium sized Ozark streams (ADEQ, 2004). Chronic erosion from poorly maintained roads and ineffective drainage systems are responsible for the next largest part of Ozark stream sediment budgets. The third component of the sediment budget is minor rill erosion from roads, trails, or treated areas (Lewis 1998). The background component of the sediment budget is represented by erosion occurring from forested land uses under healthy forest conditions. Therefore, most non-road, non-stream bank erosion yield is modest. Silviculture sediment yields are known to decay rapidly to background levels, but effects from roads persist for as long as 30 years (Hewlett 1982).

Harvesting timber can increase annual water yield because of changes in evapotranspiration of small research watersheds (Douglass and Swank 1975; Bosch and Hewlett 1982; Lee 1980). These yields are transient unless the new regime is maintained (Hornbeck et al. 1993). For areas subject to timber harvest, increased infiltration occurs when soil compaction is minimal and soil moisture content is low (Patric and Harvey 1986). This can increase summer base flows, thus expanding aquatic habitats (Keppler 1998). The effects of timber harvest on water yield decrease in magnitude with increases in drainage basin size. Multiple land use practices, geologic heterogeneity, climatic variability, and length of hydrologic records limit our ability to discern the impacts from the forest plan activities within larger landscapes. Changes in water yield resulting from forest management in the OSFNFs would be too small to determine with precision or consistency at the sub-basin level and larger.

Storm flow increases from harvested watersheds may result in decreases in evapotranspiration and interception. Research indicates that roads and skid trials have the greatest potential to result in this effect when compared to timber harvest practices (Wemple et al 1996). Actual increases in storm flow discharges and decreased hydrograph lag times are difficult to document without long, high quality hydrologic records (Jones and Grant 1996, for review). Studies confirm that storm flows increased after timber harvest in small basins, but found these effects undetectable for return intervals greater than two years, e.g., large rainfall events (Thomas and Megahan 1998).

Increased peak flows are attributed to processes that speed runoff and decrease runoff lag times. This can result from riparian area timber harvest or direct alteration of stream courses. These effects are impractical to distinguish on large basin scales for many of the reasons outlined above (Jones and Grant 1996). Increasing road densities and intersecting road ditch lines with streams also speed the runoff from small watersheds.

Timber harvest will affect nutrient cycles and can accelerate discharge of nutrients to streams (Hewlett 1982). This is considered a transient, pulsed effect that lasts until cycling is re-established by vegetative growth. Nutrient release is adverse when nutrients contribute to the acidification of water or to the eutrophication (excessive accumulation of nutrients) of the Forests' normally oligotrophic (poor in nutrients)

waters. Bringing the nutrients to normal level in the oligotrophic waters is good, but causing excessive nutrient levels creates another problem in the aquatic ecosystem. Timber harvest within the Ozarks results in the redistribution of nutrients within small watersheds, but only a portion of the nutrients is actually exported (Henderson et al. 1980). In general, southern forests retain nitrogen after harvesting disturbances because of high carbon/nitrogen ratios and rapid re-growth of vegetation (Henderson 1985).

Nutrient levels in small watersheds of the Boston Mountain indicate variable nutrient contents among watersheds in storm flows and wet seasons. These variations are influenced by soils, vegetation contribution, and atmospheric deposition (Lawson et al. 1985). Turbidity levels in storm flows are also highly variable and relatively large compared to base flow values. These qualities were noted in the absence of silviculture treatments.

Site preparation and timber stand improvement (TSI) activities should result in less soil disturbance than earlier described activities and, therefore, have little affect on the water resources. Hand tools, herbicides, and prescribed fire are the main tools used in these activities. Fire lines constructed for site preparation represent the largest potential source for erosion from these activities. Herbicides used for site preparation are applied by direct injection or foliar spray, not broadcast. Use is infrequent (1 to 2 times per 100 yrs.) and direct application methods minimize off-site movement. Monitoring for herbicide concentrations following use has been a continuous policy on OSFNFs for the last 10 years. Results have not documented any significant concentrations of herbicides or off-site movement (OSFNFs records). Other monitoring efforts found that subsequent to runoff-producing precipitation events, concentrations of herbicide (triclopyr) in ephemeral streams with State BMP protections were very small and well below any significant risk concentration.

To summarize the effects of vegetation management on the water resources, it is useful to use the average annual acres of harvest (Table 3-9) as a proxy for the potential of the above effects to occur. This overview provides us with an idea of how the effects from each alternative will differ because at this level the plan does not indicate the specific location or technique that will be used to implement the activities. Forest-wide standards will be adopted that are necessary to minimize and/or mitigate the risks associated with these and all other ground disturbing impacts.

Table 3-9: Potential/Effects to Water Resources/Vegetation Management Activities.

Evaluation Criteria	Alternatives				
	A	B	C	D	E
Average Annual Harvest Treatments (Acres)	14,500	13,000	14,500	14,500	14,500
Potential for Effects from Vegetation Management	4th	Least	2nd	Most	3rd

One key factor of Table 3-9 is that it demonstrates a similar number of acres for each alternative to be treated with vegetation management activities. However, each

alternative would utilize different management activities, thus allowing similar sized impacts that could result in different potential effects. Because Alternative D would utilize more intensive vegetation management strategies such as heavy thinning and regeneration harvesting, Alternative D would potentially have the greatest effects on the water resources.

Alternatives C and E could potentially increase water production because these alternatives have 200,000+ acres managed as woodlands. Woodlands have a lower evapotranspiration regime, potentially providing higher base flow to the streams in the management area during the dry summer and fall months. This effect would only be realized if the woodland landscape is concentrated within a few watersheds, and the conditions required to minimize evapotranspiration were maintained.

Alternative B would be the least likely to effect water resources because of the larger amount of land scheduled for basic custodial care where minimal amounts of vegetation management would occur.

Recreation

Changes to water quality and stream morphology are direct effects of developed recreation. Examples of impacts to water quality include increased erosion and sedimentation from multi-use trials, elevated concentrations of bacteria in swim areas and river access points, and potential contamination from mechanical fluids and foreign materials. OHV use has grown substantially in the past decade and this type of recreation pressure has increased on the Ozark NF. Unfortunately, this activity has a particularly distinctive impact on the landscape. Unauthorized trials can create erosion problems similar to that of poorly designed roads. Dispersed use causes resource damage and can materialize into serious problems if non-sustainable use occurs. These activities have been concentrated within stream channels and riverbeds at some locations, thus, impacting stream morphology and aquatic habitats. Developed recreation tends to be concentrated around the water resources of the Forests. These areas are impacted by foreign material (trash), contamination by mechanical fluids (gas and grease), and soil erosion from heavy use.

All of the alternatives will experience impacts to the water resources because of the naturally expanding magnitude and variety of recreation uses across the Forests. Under the majority of the conditions, most recreation uses neither pose nor are expected to pose a significant threat to the water resources on the OSFNFs. The current impacts resulting from recreation are expected to continue to exist. Inattention to dispersed recreation issues raises the potential for significant impacts to water quality and aquatic habitats. Alternatives B and E present opportunities for more effects to result from concentrated developed recreation uses; however, this option may be necessary to address inappropriate dispersed recreation uses. There is no method for predicting the extent or magnitude of effects resulting from recreation uses.

Fire Management

Each alternative proposes prescribed burning for fuel reduction, ecosystem restoration, and site preparation. The effects of prescribed fire vary depending on fire severity, type, fuel characteristics, soil moisture, and recurrence interval. Prescribed burns designed to remove understory implemented under managed or controlled conditions have negligible effect on the physical, chemical, and biological properties of soils and soil productivity. There is little evidence that sedimentation or water yield increases significantly in steams from forestlands burned under conditions specified in a prescribed burning plan designed to meet wildlife, recreation, watershed, vegetation management, or ecological objectives.

Consumption of fuels by fire will create ash, which can be eroded, dissolved, deposited, or transported to the aquatic systems. Suspended solids and dissolved salts or metals could be contributed to stream flow via surface runoff. This is most likely when an infrequent, large precipitation event immediately follows a controlled burn. The organic layer and root mat is expected to remain intact after a prescribed burn, which should not create conditions for soil erosion. As fire severity increases, the chances for increasing damage to the soil structure also increases. This could trigger a greater chance of accelerated erosion. Extremely severe fires (such as wildfires) attributed to heavy fuel loads, active fire weather, and stand replacement would result in these effects. Ground disturbance created by fire lines, especially by bulldozers, could result in accelerated soil erosion, and pose a distinct source of erosion potential from prescribed fires. Forest-wide standards and Arkansas' BMPs have been identified to minimize the impacts of these effects.

To summarize the effects of fire management on the water resources, it is useful to use the average annual acres of prescribed fire expected for each alternative (Table 3-10) as a meaningful substitute for the potential of the above effects to occur. For all the alternatives, forest-wide standards will be adopted that are necessary to minimize and/or mitigate the risks associated with these and all other ground disturbing impacts. Alternatives C and E will require a short rotation on burns scheduled for woodland maintenance. Once the first burn is accomplished in these woodland areas, successive burns will result in a lower potential for effects to result from this activity.

Table 3-10: Potential for Effects to Water Resources/Fire Management Activities.

Evaluation Criteria	Alternatives				
	A	B	C	D	E
Annual Prescribed Fire (acres)	70,000	80,000	150,000	90,000	120,000
Potential for Effects from Fire Management	Least	4th	Most	3rd	2nd

Transportation and Access

Roads are considered the most common source of accelerated erosion on national forest lands. Road generated sediment would be produced from erosion of cut and

fill slopes, ditches, road surfaces, and road maintenance operations. Raw ditch lines and roadbeds would be a continual source of sediment, usually due to lack of maintenance, inadequate maintenance, excessive ditch line disturbance, or poorly timed maintenance. Unpaved roads paralleling and crossing streams pose specific risks to water quality.

Roads have three primary effects on the hydrologic cycle of forested lands. They can intercept rainfall directly, concentrate flow, and divert or reroute water from traditional hydrologic pathways. Through these actions, road systems mimic the stream channel network by effectively increasing the drainage density of streams in the landscape. This can result in modifications to the timing of water delivery to streams thus influencing peak flows.

Aquatic habitats are directly threatened by the fragmentation and modification associated with dams and roads. Dams act as a barrier to the movements of aquatic species. Roads that cross streams require a pathway (bridge or crossing structure) that may also act as a barrier to the movement of aquatic species. Road crossings, especially older structures, often did not receive the design considerations or proper maintenance required to function without posing a habitat fragmentation risk. Table 3-11 shows the potential effects that transport and access activities have to water resources.

At this level of planning, bulk changes in the characteristics of the road system can only be estimated. Therefore, a simplification was necessary because specific information regarding road construction locations or magnitudes was not developed for this plan. The effects of roads are best determined at the project planning level where specific information about the location; soil types; slope and landforms; and proximity to water bodies can be determined. It was determined that as road construction requirements for implementing each alternative changes, so do the potential for effects of roads on water resources. Greater numbers of new road construction increase the potential for direct and indirect effects to occur. Alternative D has the greatest number of new road construction miles required for activity implementation and Alternative B has the lowest number of new road construction miles required for activity implementation.

Table 3-11: Potential for Effects to Water Resources-Transport and Access Activities.

Evaluation Criteria	Alternatives				
	A	B	C	D	E
Road Construction (miles/Decade 1)	41	33	39	42	37
Road Maintenance (miles/Decade 1)	4,888	3,997	4,692	5,027	4,406
Potential for effects from Construction/Maintenance	4th	Least	3rd	Most	2nd

Minerals Management

A limited amount of mineral activity occurs on the Forests and this trend is not expected to change dramatically over the next planning period. Natural gas well exploration and drilling are the most likely minerals issues that the Forests may encounter. There are currently natural gas well locations across the Forests being operated under special use permits. These sites are subject to many of the same erosion concerns and effects described in the activities above. Gas wells require access, an area of cleared land, and the infrastructure to remove the resource. Erosion from the access roads, land clearing, and pipeline construction are the main concerns from these activities. Arkansas' BMPs and erosion control plans for operation are normally utilized to minimize these effects. In some cases, extraction of natural gas will produce a brine water solution that must be disposed. There is a risk that improper management, or disposal, will result in an adverse affect to water quality.

The effects of this activity on the water resource would remain constant across all alternatives.

Off-Stream Uses

Population growth of rural areas in northern Arkansas may eventually require the use of surface water as a drinking water supply because of the limited ground water resources. Industry and agriculture water uses are minimal in this area because of the limited nature of water resources and the infrastructure required supporting their use. The forested land use that is common across the Forests lends itself to naturally producing high quality water. This makes forested land a valuable water source for public water supplies. Currently there are few off-stream water uses within the Forests' boundaries; the uses that exist have minimal water requirements. If demand arises for a larger number of off-stream water supplies, forest policies may be necessary to address these issues. These off-stream uses must be coordinated with the appropriate state agencies.

The effects of this activity on the water resource would remain constant across all alternatives.

Point Source Discharges

Across the OSFNFs, there is a much lower concentration of regulated point source discharges compared to the rest of the state. The activities and uses associated with this plan will not require point source discharges by national forest facilities. Expanding uses and urbanization on private land may result in additional point source discharges within the administrative boundaries of the Forests, but these will not be the result of FS activities. These users would have to coordinate their discharges with the appropriate state agencies. As developed recreation uses intensify, there may be a need for waste treatment systems on the Forests; however, these would be designed to not require a point discharge permit.

The effects of this activity on the water resource would remain constant across all alternatives.

Cumulative Effects

"A cumulative effect is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

In earlier planning efforts, sediment and water yield increases over time. This served as a surrogate for changing conditions and provided a method of quantifying potential effects. Watershed conditions were described in physical terms, not in terms of aquatic health. During this planning effort, the opportunity was available for a comprehensive evaluation of the conditions.

The Ozark Plateaus National Water Quality Assessment Program (USGS) has studied the existing land uses and their impact on the water quality in the region. Trends that show increased nitrogen, phosphorous, and coliform bacteria concentrations occur with increases in agricultural and urban land uses (Davis and Bell 1998). Forested land uses have a much lower concentration of these elements. These records do not isolate the cumulative effects of timber harvest in nutrients, but they do illustrate the water quality impacts of alternative land uses in the Ozarks.

Long-term measurements of water quality chemistry find that nutrient losses observed in commercial logging are small, and should not adversely affect water quality (Swank et al. 2001). The natural water chemistry in the OSFNFs is very oligotrophic; therefore, minor, temporary increases in nutrient composition should not threaten the attainment of designated uses for surface water. Land conversion and alternative land uses, such as agriculture and urbanization, could result in significant sources of nutrients to the forests' streams.

Sediment is an appropriate measure to determine the effects of management activities on water quality and their impact on the beneficial uses of forest water bodies (Coats and Miller 1981). Sediment increases can adversely affect fish productivity and diversity, degrade drinking water, and influence recreational values (Alexander and Hansen 1986). Other cumulative impacts, such as changes in water yield, could result from activities described by the Revised Plan. However, a water yield model that characterizes the entire suite of management activities for the Forest area is not available. Changes in water yield will often exist within the natural range of variability; climatic processes drive most of the water yield variability. Changes in nutrient content are expected to be minimal and not representative of cumulative effects at the forest plan level. Therefore, this analysis uses a model to estimate sediment yields in order to represent the cumulative effects to water quality and aquatic health.

Cumulative effects analysis is bound in space and time. For this analysis, 5th level watersheds were chosen for the spatial boundaries. The implementation period for a forest plan is 5 to 15 years; the period chosen for this analysis is 5 decades (50 years). This allows for a comparison of past, present, and future conditions for entire watersheds including public and private lands over a period of 50 years.

For this analysis, it was possible to estimate the background and current watershed sediment yields based on land uses and information garnered from scientific literature. Future watershed sediment yields were estimated using the descriptions of the activities in each alternative. Vegetation management, existing land uses, anticipated road construction and maintenance, private land uses, and ecoregion classifications were included as parameters for modeling the sediment budget within a GIS (Geographic Information System) environment. A brief description of the analysis is included here. A detailed description of data sources and the analysis process can be found in a process paper on file at the OSFNFs' Supervisor's Office.

A sediment budget was estimated for the implementation of each alternative to determine the potential cumulative effects to water quality, beneficial uses, and aquatic health. Then, the sediment budgets were compared to a calculated background value, which assumes an unroaded forest landscape. Increases above this background level were determined and the value was used to classify the Watershed Condition Rank (WCR). Watershed Condition Rank is a measure of risk to aquatic health that may result from changes in sediment loads.

First, current aquatic health was determined, and then WCRs were established. Aquatic health was determined from biological stream assessments at sites across the Forests. The result from each sampling location was scored according to the populations within different ecological assemblages. The watershed above each site was delineated and the sediment budget within the watershed was estimated. The aquatic health scores and sediment budget values were then used to describe a relationship between these parameters. These relationships suggested that increases within sediment budgets were inversely related to the aquatic health scores.

Quartile divisions were established to determine the classifications for each risk category. This classification resulted in the identification of two threshold values for establishing aquatic health and, subsequently, the WCR. The upper quartile (least disturbed, least sediment) was classified as a low risk to watershed condition. The next quartile was classified as a moderate risk and the two bottom quartiles classified the greatest risk of adverse biotic response. Table 3-12 shows the watershed condition rank thresholds for the different ecoregions. An explanation of each risk level follows the table.

The next step required the use of the estimated sediment budgets for each alternative. The sediment budget results for each alternative were appropriately distributed across the 50 distinct watersheds. For each watershed, a comparison was made between the background and alternative implementation estimates. The differences between these values were identified and compared to the WCR

thresholds. The effects were classified according to risk they posed to the aquatic health of the water bodies. The results are shown in Table 3-12.

Table 3-12: Watershed Condition Rank Thresholds for Sediment Identified for Cumulative Effects Found on the Four Ecoregions of the OSFNFs.

Risk Level	Ecoregion			
	Arkansas Valley	Boston Mountain	Delta	Ozark Highlands
Low	0 to 311	0 to 456	0 to 4800	0 to 2817
Moderate	311 to 623	456 to 913	4800 to 9601	2817 to 5635
High	> 623	> 913	> 9601	> 5635

***Values given represent the percent increase above a background erosion value.**

WCR has three categories of risk: high, medium, and low. This does not translate into an excellent or poor watershed but categorizes the watersheds based on the risk to their current condition.

- When a watershed risk level is low, the probability (or potential) is low for adverse effects to aquatic species. If the results of forest alternatives remain within this range, there should be no adverse effect on water quality with respect to beneficial uses (fish communities).

- When a watershed risk level is moderate, the potential to adversely affect beneficial uses is moderate. Project level planning should seek to identify the source of the problem, and conduct monitoring prior to project implementation to establish actual health of the biota.

- When a watershed risk level is high, the potential to adversely affect beneficial uses is high. Project level planning should seek to identify the source of the problem, conduct monitoring prior to project implementation to establish actual health of the biota, and design the project activities to have no net increase in sediment yields.

The assumptions included in this analysis have been documented. Sediment budgets, like all models, require many assumptions that may affect their performance. With that in mind, estimated sediment budgets and the associated WCR do not represent absolute values but do relatively describe the effects across a range of alternatives. This method of estimation indicates which watersheds currently have, or may have as the result of plan implementation, greater risks to their aquatic health and water quality. Table 3-13 gives the current watershed condition ranks as well as the WCRs for the 5th level watersheds on the OSFNFs by alternative.

Table 3-13: Watershed Condition Rank, Current and by Alternative for First Decade. No Change Exists from these Values for the Duration of this Analysis (5 Decades).

Hydrologic Unit Code	Percent FS	Current WCR Risk	Period 1- First Decade WCR				
			Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
802010002	10.76	Low	Low	Low	Low	Low	Low
802020334	45.89	Low	Low	Low	Low	Low	Low
802020513	0.57	High	High	High	High	High	High
802030404	1.94	High	High	High	High	High	High
802030405	0.29	High	High	High	High	High	High
1101000101	42.64	Low	Low	Low	Low	Low	Low
1101000102	11.90	Low	Low	Low	Low	Low	Low
1101000103	5.43	Low	Low	Low	Low	Low	Low
1101000104	0.09	High	High	High	High	High	High
1101000106	0.27	Low	Low	Low	Low	Low	Low
1101000109	5.18	Low	Low	Low	Low	Low	Low
1101000401	22.31	Low	Low	Low	Low	Low	Low
1101000403	19.84	Low	Low	Low	Low	Low	Low
1101000404	44.49	Low	Low	Low	Low	Low	Low
1101000501	28.75	Low	Low	Low	Low	Low	Low
1101000502	19.62	Low	Low	Low	Low	Low	Low
1101000503	39.68	Low	Low	Low	Low	Low	Low
1101000505	14.61	Low	Low	Low	Low	Low	Low
1101001403	19.30	Low	Low	Low	Low	Low	Low
1101001404	0.60	Low	Low	Low	Low	Low	Low
1111010301	9.06	Mod	Mod	Mod	Mod	Mod	Mod
1111010303	0.76	Mod	Mod	Mod	Mod	Mod	Mod
1111010304	0.54	Mod	Mod	Mod	Mod	Mod	Mod
1111010306	5.27	Low	Low	Low	Low	Low	Low
1111010307	0.36	Low	Low	Low	Low	Low	Low
1111010404	28.04	Low	Low	Low	Low	Low	Low
1111010405	2.67	Mod	Mod	Mod	Mod	Mod	Mod
1111020104	36.34	Low	Low	Low	Low	Low	Low
1111020105	6.17	High	High	High	High	High	High
1111020106	72.11	Low	Low	Low	Low	Low	Low
1111020107	81.98	Low	Low	Low	Low	Low	Low
1111020108	13.70	High	High	High	High	High	High
1111020109	2.10	High	High	High	High	High	High
1111020204	32.59	High	High	High	High	High	High
1111020205	14.37	High	High	High	High	High	High
1111020206	15.74	Mod	Mod	Mod	Mod	Mod	Mod
1111020207	2.68	High	High	High	High	High	High
1111020208	44.89	Low	Low	Low	Low	Low	Low

Table 3-13: Watershed Condition Rank, Current and by Alternative for First Decade. No Change Exists from these Values for Duration of this Analysis (5 Decades). (Continued)

Hydrologic Unit Code	Percent FS	Current WCR Risk	Period 1- First Decade WCR				
			Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
1111020209	82.08	Low	Low	Low	Low	Low	Low
1111020210	54.48	Mod	Mod	Mod	Mod	Mod	Mod
1111020211	70.54	Low	Low	Low	Low	Low	Low
1111020212	85.01	Low	Low	Low	Low	Low	Low
1111020213	77.12	Low	Low	Low	Low	Low	Low
1111020214	7.00	High	High	High	High	High	High
1111020215	0.70	High	High	High	High	High	High
1111020305	13.28	Mod	Mod	Mod	Mod	Mod	Mod
1111020306	45.22	Mod	Mod	Mod	Mod	Mod	Mod
1111020402	7.29	Mod	Mod	Mod	Mod	Mod	Mod
1111020403	15.69	High	High	High	High	High	High
1111020404	27.38	Mod	Mod	Mod	Mod	Mod	Mod

This analysis indicates that management activities proposed by the various plan alternatives result in similar cumulative effects. The cumulative effects resulting from sediment, as depicted by the watershed condition rankings, do not change from the current condition. As modeled for this analysis, the cumulative impacts of sediment based on the timber harvesting and road-building activities identified for the alternatives of the Revised Plan will not significantly change for any alternative.

RIPARIAN, WETLANDS, AND FLOODPLAINS

Affected Environment

Riparian areas include the water body, and the transition area between aquatic systems and upland terrestrial systems. Riparian areas are functionally defined as areas with layers of interaction that include both terrestrial and aquatic ecosystems. They extend down into the groundwater, up above the canopy, outward across the floodplain, laterally into the terrestrial ecosystem, and along the watercourse at avariable width (Ilhardt, 2000). Wetlands (including beaver ponds) and floodplains are commonly associated with the riparian areas found along side the major streams and rivers of the forest.

The OSFNFs contain an estimated 1,300 miles of perennial streams. Management Area 3.I (Riparian Corridors) is used to identify the riparian area associated with large streams and rivers and is estimated to be about 11,484 acres. The riparian corridor is a fixed width area for management purposes. However, the riparian corridor acreage is not the same as actual "defined-on-the-ground" riparian area acreage.

True riparian area acreage on the Forests is believed to be larger than the acreage associated with riparian corridors, but this assumption has not been validated. Measures for identifying and incorporating these areas are given in the Riparian Corridor Management Area. Further explanations of these areas are in the "Rare Communities" and "Major Forest Communities" sections.

Extensive wetland areas do not exist across the majority of the Forests. In most cases when wetlands do occur, they are riverine and palustrine wetland areas that are associated with river and streambeds, and palustrine and lacustrine areas associated with lake and reservoir beds. Additional wetland areas along rivers and streams, and associated with springs and seeps are likely. Occasionally, upland areas support small bogs or marsh features that have the characteristics of a wetland; however, these are very small and not represented in maps. The intent is that these areas are discovered during project level planning and through careful interpretation of aerial photos. The St. Francis NF has many areas that can be classified as wetlands and floodplains. These areas fall within the Bottomland and Floodplain Forest Communities.

Healthy and properly functioning riparian areas, wetlands, and floodplains are physically and biologically diverse and highly productive environments. These land-water interfaces are generally very dynamic and support complex associations of plant and animal communities. Riparian areas maintain or improve water quality, regulate impacts of flooding, and provide continuous groundwater recharge areas. The areas are also attractive for their diverse scenery and recreation potential. Riparian areas act as a buffer to:

- Trap sediment and nutrients moving from upland areas.
- Regulate stream temperatures.
- Provide streamside cover and food for wildlife.
- Provide large woody debris reserves and organic matter to riparian areas and aquatic systems.
- Maintain overall channel stability
- Control cumulative effects of actions within the watershed.

Prior to becoming lands of the Ozark NF, many of the larger floodplain areas associated with streams and rivers were logged, farmed, and grazed. Access roads were often built in riparian areas due to the relative ease of construction. Besides the obvious changes to riparian vegetation that resulted, other effects included compaction of riparian soils, accelerated erosion/sediment delivery to streams and rivers, and changes to the stream geomorphology.

As lands were acquired and became part of the Ozark NF, a new forest began to mature in riparian as well as upland areas. Today, riparian areas are generally in a mid-to late-successional stage of forest development. Most disturbances in these areas are the result of access roads, trails, developed recreational area improvements, and dispersed recreation activities. Natural disturbances also result from floods, wind, ice, insect infestations, and disease damage.

An assessment of riparian functioning has not been completed on forest riparian areas. Most of the areas are believed to be functioning at or near their proper capability and potential. Where roads and concentrated recreation (dispersed and developed) exist in riparian areas, proper functioning condition could be at risk or non-functioning. Besides unchecked dispersed recreation, the second largest threat to riparian functioning is the introduction of non-native species. Since non-native species may thrive in disturbed landscapes, these dynamic environments provide the opportunistic setting they flourish in, ultimately crowding out native species necessary for proper riparian functioning.

Direct and Indirect Effects

Resource protection has been integrated into the forest-wide standards for soil, water, watersheds, aquatic, riparian, wetlands, and floodplains at various scales ranging from forest-wide to site-specific. This direction would result in maintaining or improving these resources and affected beneficial uses. Land management activities on national forest lands are conducted only after project level analysis has been conducted. Project level analysis provides an opportunity to identify and minimize direct, indirect, and cumulative environmental effects that cannot be specifically determined or analyzed at the large scale of this FEIS.

Operations involved in timber management, recreation use, roads, and prescribed fire that cause disturbance of soils, stream channels, or associated resources influence the level of disturbance within a watershed. Disturbances that occur from these activities may contribute an increased risk to the current condition of the riparian area. These risks would be temporary and localized causing impacts that would affect the function and condition of riparian areas, floodplains, wetlands, and the associated aquatic habitats. If a riparian area is not currently providing the functions and values necessary, or is already at risk, then management activities and their associated disturbances may result in a benefit to the riparian values.

Implementation of Arkansas' BMPs, the standards associated with the Management Area 3.I, and forest-wide standards will minimize the amount of soil disturbance and the potential for sedimentation. The riparian corridor will encompass a large portion of the acreage of the riparian areas, wetlands, and floodplains. Streamside Management Standards (SMZs) included in all alternatives require the description and protection of a designated buffer between management activities and water bodies.

Damage to watersheds, riparian areas, wetlands, and floodplains can occur from recreational activities. Developed and dispersed camping can result in stream bank and in-stream disturbances and soil compaction, and can also affect the type, density, and vigor of vegetation. The increased use of OHVs has accelerated damage within riparian areas and stream channels. Most of the disturbances are localized, but they can have a profound effect on the quality and function of these resources. Restrictions on access, ground disturbance, and vegetation alteration will be used, and are intended to minimize impacts to these resources.

Prescribed and wildland fire can affect soil infiltration rates, surface erosion potentials, overland flow, and vegetation composition in riparian areas, floodplains, and wetlands. These impacts have the potential to occur if prescribed fire enters these areas when conditions are outside the prescription "window." No specific prescribed fire treatments are identified in these areas, however, the potential exists if the adjacent upland areas undergo prescribed burning. Implementation of the forest-wide standards, riparian corridor standards, and Arkansas' BMPs will provide protection from prescribed burning to these areas.

No management is expected to occur without an evaluation for wetland existence. Upon identification these areas will be set apart from the planned project and no alterations will be made to the wetland functioning. Therefore, wetland areas will not be impacted by any plan alternatives.

While the Riparian Corridors MA is classified as suitable for timber production, the Revised Plan does not intend for timber volume to be the main product of its management. Timber volume is best described as a secondary benefit from management, with the first being the restoration of riparian functions and values..

Some active vegetation management is needed for riparian health, and for riparian dependent species (see "Terrestrial Species Viability," Page 3-230).

Cumulative Effects

The cumulative effects of the combined past, present, and reasonably foreseeable activities within the Forests that have the potential to measurably affect values and functions of riparian areas, wetlands, and floodplains include timber harvesting, road construction and maintenance, recreation, and prescribed burning. Of these, road construction and maintenance represent the greatest impact on these areas forest wide. Vegetation management may occur occasionally where needed for improvement or enhancement of riparian dependent species. However, harvest may occur occasionally where needed for improvement or enhancement of the resources occurring in the areas. No road construction is specifically proposed in these areas; however, maintenance of existing roads will continue to occur as needed. Forest-wide prescribed burning is proposed, but will not occur in these areas except as needed for control areas. The potential for fire to impact riparian areas, wetlands, and floodplains is directly dependent on the acres burned.

Riparian areas, wetlands, and floodplains are naturally dynamic. That is, they change over time. Goals common to all alternatives address maintaining riparian, wetland, and floodplain characteristics that are good and improving or restoring those areas determined to be in less desirable condition. The alternatives vary slightly in addressing the health and function of these areas due primarily to the implementation of the riparian corridor prescription, Arkansas' BMPs, and other requirements of laws and regulations. The actual rate of potential change for individual areas cannot be determined at the Forest Plan scale. Each individual riparian area, wetland, or floodplain will respond differently to various management

practices, the type and degree of disturbance, restorative measures taken, natural physical processes, and climate. Because management activities could result in both negative and beneficial effects, there are no meaningful analysis measures at this scale.

AIR RESOURCES

Affected Environment

Federal land management agencies have the unique responsibility under their respective authorities to protect the air, land, and water from degradation associated with air pollution emitted outside the borders of Agency lands (Clean Air Act 1990), as well as from the impacts of air pollutants produced within those borders. These mandates are established through a series of legislative and regulatory requirements (Clean Air Act 1990; Organic Act 1977, Wilderness Act 1997). With the burden of these responsibilities, it is important for federal land managers to understand the rules and regulations governing air pollutant emissions and how those air pollutants are affecting forest resources.

First, the Clean Air Act (CAA) sets the standards for the air quality in the United States. Of the numerous sections of CAA, two are particularly important to National Forest System (NFS) management: National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD). The NAAQS set the air quality standards for six criteria pollutants with which the entire country must comply. Primary NAAQS are set based on human health criteria. It is up to the state air quality regulatory agencies to come up with State Implementation Plans (SIPs) to ensure that these standards are met in their respective states. If the standards are not met for any criteria pollutant, the area is designated as non-attainment for the pollutant. It is the responsibility of the OSFNFs to ensure that management activities do not significantly contribute to a violation of the NAAQS.

Additionally, the Clean Air Act Amendments (CAAA) of 1977 established the Prevention of Significant Deterioration (PSD) program. These amendments designated specific wildernesses and national parks as Class I Areas. The OSFNFs manage one Class I Area, the Upper Buffalo Wilderness. There is another Class I Area in Arkansas, the Caney Creek Wilderness, managed by the Ouachita National Forest. Federally mandated Class I Areas are provided with an additional measure of protection under Title I, Part C of the CAAA, which states that one purpose of the Act is "to preserve, protect, and enhance the air quality in national parks, national wildernesses." Furthermore, the PSD regulations charge the federal land manager with the "affirmative responsibility to protect the air quality related values (including visibility) of any such lands," and to consider "whether a proposed source or modification would have an adverse impact on such values" (40 CFR 51.166 [p][2]). In light of this responsibility, it is important for federal land managers to be familiar with the status of air quality in and near the Class I Areas, as well as how current levels of air pollution are impacting Air Quality Related Values (AQRVs). This information assists federal land managers when making impact determinations about new sources of air pollution.

The authority and responsibility to protect resources within NFS lands is not limited to Class I Wildernesses, but requires federal land managers to take the necessary steps to protect all federal lands from air quality impacts, regardless of whether those impacts are coming from within Agency borders or without. The CAA of 1990 contains numerous sections dealing with these responsibilities, and Section 101(c) states the primary purpose of the Act:

> "A primary goal of this Act is to encourage or otherwise promote reasonable Federal, State, and local governmental actions, consistent with the provisions of this Act, for pollution prevention" (Clean Air Act 1990).

Beyond the CAA, additional legislation recognizes the importance of air quality and the impact it can have on forest resources. NFMA states that Land and Resource Management Plans are specifically based on:

> "…recognition that the National Forests are ecosystems, and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems" (National Forest Management Act 1976).

It is within this regulatory framework that the OSFNFs must strive to protect resources on NFS lands from the detrimental effects of any pollution source. Additionally, it is imperative that while federal land managers work to alleviate harmful effects of air pollution from new and existing sources external to forest boundaries, they must also continue to be good stewards when conducting management activities that contribute to regional air pollution.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect air quality in and around the Forests.

Background to the Issue and Indicators

Although a majority of this area's pollution comes from sources outside the national forest, activities from within the forest boundaries can also influence air quality in the region. Activities such as timber harvesting; oil and gas well drilling and operations; road construction or maintenance; and prescribed fire all produce emissions. However, only prescribed fire is expected to change significantly for all alternatives within the timeframe of this planning period. Particulate matter (PM) and nitrogen oxide (NOx) emissions from prescribed fire activities will contribute to the total pollution load, and are the major pollutants of concern in terms of contributions to NAAQS. Therefore, potential emissions of these pollutants will serve as indicators for air quality effects.

Indicators

Potential missions of PM from prescribed fire activities will be evaluated in comparison to total PM emissions in counties near the Forests.

Scope of the Analysis

Analyses for direct and indirect effects of air pollution are limited to pollution emitted from within lands administered by the Forests as a result of management activities. However, because air pollution disperses beyond political boundaries, levels of pollution emitted from forest management activities must be evaluated taking into consideration regional pollution loads and current air quality monitoring data. Pollution coming from forest management activities can affect air quality within forest boundaries and without. Likewise, pollution from sources outside the Forests' boundaries affects Forests' resources as well as regional air quality. For this reason, air pollution must be evaluated in both a regional and cumulative context; and it is imperative that an area larger than just NFS lands is used in an air quality evaluation. An analysis area with a radius of 50 kms from the Forests' boundaries will be used to describe the effects of emissions from the Forests on regional air quality in this document. This distance was determined to be adequate to describe the area potentially affected by the mobile and area sources of pollution from forest management activities. Figure 3-6 shows the analysis area.

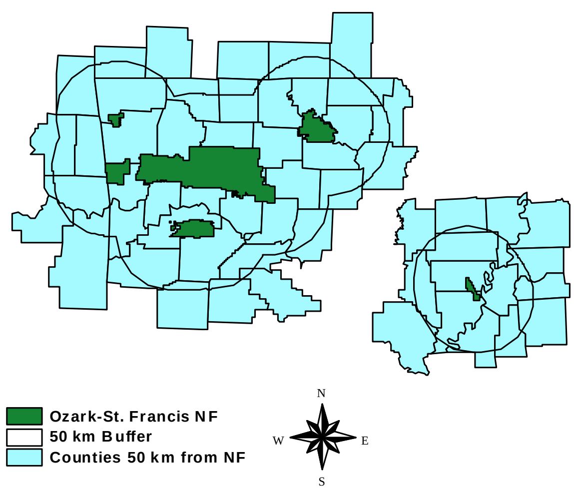

Figure 3-6: Air Quality Assessment Analysis Area

Current Conditions

Current air pollution impacts occurring on the OSFNFs are the cumulative result of numerous sources. When looking at the impacts of air quality on Forests' resources, it is important to keep in mind that only a handful of pollutants contribute to a variety of air quality related issues. These pollutants are a concern because of their impacts

to both human health and ecosystems, and are described in detail below. Air pollutants are generally classified as either primary or secondary pollutants. Those emitted directly into the atmosphere as products of combustion are classified as primary pollutants, and those formed when primary pollutants undergo atmospheric chemical reactions are secondary pollutants.

Sulfur Dioxide (SO_2)

About 69 percent of SO_2 released to the air (11.2 million tons in 2000), comes from electric utilities, especially those that burn coal (US EPA, Progress Report 2002). Other sources of SO_2 are industrial facilities that derive their products from raw materials—like metallic ore, coal, and crude oil—or that burn coal or oil to produce heat. Examples are petroleum refineries, cement manufacturing, and metal processing facilities. In addition, locomotives, heavy marine equipment, and some non-road diesel equipment currently burn high sulfur fuel and release SO_2 in large quantities. Within 100 kilometers of the Forests, there are 35 coal-fired electric generating units (EGUs). The ten largest point sources of SO_2 located within 200 kilometers of the Forests (Table 3-14) are also among the top 50 highest SO_2 emitting EGUs in the nation (US EPA, 2003 eGRID database, 2002 data). (Note: Some of these facilities may have made reductions since the time the EPA eGRID data was compiled.) Once SO_2 is emitted into the atmosphere, it undergoes chemical transformations to form secondary pollutants such as sulfates and sulfites. In the eastern United States, these secondary sulfur pollutants are the major contributors to visibility impairment and acidic deposition.

Table 3-14: Ten Largest Point Sources of Sulfur Dioxide (SO_2) Emissions in the 200 km Analysis Area (1999 data).

Tons/Year of SO_2	Source Name	Location
111,619	Texas Utilities Electric Co	Rusk Co., TX
100,122	Texas Utilities Electric Co	Titus Co., TX
38,206	White Bluff	Jefferson Co., AR
37,958	Southwestern Electric Power Co.	Titus Co., TX
32,019	Entergy Mississippi Inc.	Washington Co., MS
31,456	Alumnitec Inc.	Garland Co., AR
29,669	Oklahoma Gas & Electric	Muskogee Co., OK
28,900	Entergy Mississippi Inc.	Warren Co., MS
26,839	Doe Run Company	Iron Co., MO
26,674	Independence	Independence Co., AR

Sulfur Dioxide and Acid Deposition

Acid deposition occurs when acidic compounds in the atmosphere are deposited on the earth’s surface through rain, clouds, snow, fog, or as dry particles. These acidic inputs can contribute to degradation of stream water quality and decrease the amount of available base cations in the soil substrate. Many factors, most notably the bedrock geology/lithology types and the level of acidic inputs, influence an ecosystem’s susceptibility to soil nutrient losses and decreases in stream water acid

neutralizing capacity (ANC). Areas that receive high levels of acidic deposition and have bedrock geology with a naturally low buffering capacity may exhibit nutrient depletion and stream acidification. Stream chemistry data shows that streams on the Forests have stable ANC values; however, there currently is some potential that soil nutrient depletion is occurring in sensitive areas. There are four National Atmospheric Deposition Program (NADP) monitoring sites in Arkansas, but the Clark County site is located closest to the Forests. The Fayetteville site located in Washington County, which began monitoring in 1980, has the longest data record of the four sites. The Warren and Fayetteville sites began monitoring in 1982. The Caddo Valley site in Clark County began monitoring in 1983.

It is important to note that trend analyses for NADP sites show a general decrease in the levels of sulfate (SO_4) deposition throughout the nation, especially over the last 10 years. Of the Arkansas monitoring sites, this observed trend is most prominent in the data from the Fayetteville site. The decline in SO_4 deposition at NADP sites is consistent with the decreases in utility SO_2 emissions brought about by the Acid Rain Program (Title IV) of the 1990 Amendments to the CAA. The Acid Rain provision mandated significant reductions in SO_2 emissions.

Downward trends in SO_2 emissions and SO_4 deposition are predicted to have a positive effect on aquatic and soil resources on the OSFNFs; however, the reductions are not great enough to fully reverse all the degradation that has already taken place. Additional emission reductions will be needed to restore already degraded streams, and to protect streams that have not yet degraded.

Sulfur Dioxide and Regional Haze

During the last four decades, the eastern United States has seen a significant regional reduction in visibility, brought on by a corresponding increase in ambient levels of visibility-impairing pollutants often referred to as fine particulates (Malm 1999). The estimated natural background visibility for the eastern United States is 93 ± 28 miles (NAPAP 1990), but average annual visibility at Caney Creek and Upper Buffalo Wildernesses is now only 31 miles (IMPROVE Data 2003). This degradation of visibility, both in terms of how far one can see and the clarity of the view is called regional haze. Although many fine particulate components such as elemental and organic carbon and nitrates contribute to visibility impairment, the major visibility-impairing pollutant in the eastern United States is sulfate, which comprises most of the measured fine particle mass (IMPROVE Data 2003). Furthermore, sulfate particles are considered hygroscopic, which means their effectiveness in impairing visibility is magnified with increasing relative humidity. A humid atmosphere alone does not result in visibility reductions, but sulfate particles grow in size when they attach to atmospheric water molecules; a size that is more effective at scattering the sun's light (Malm 1999). About 60 percent of SO_2 emitted nationally comes from coal-fired power plants (US EPA, National Air Quality and Emissions Trends Report Data 2003). Organics (released primarily from vegetation as volatile organic compounds [VOCs]) are the second most important fine particles measured.

The Interagency Monitoring of Protected Visual Environments (IMPROVE), a national network of particulate monitors established for the protection of Class I Wilderness Areas, has monitored the constituents of regional haze for more than two decades. The IMPROVE monitor located on the OSFNFs is at Deer, Arkansas, near Upper Buffalo Class I Area. IMPROVE data from the Upper Buffalo monitoring site were used in the visibility description that follows.

Sulfate transported from the eastern United States in the summer is the major cause of haze in the Upper Buffalo Wilderness Area in Arkansas. Sulfate in average contributes approximately 60 percent to regional haze during the 20 percent worst haze days observed at the site UPBU1 (Upper Buffalo 1) based on 6 years of IMPROVE data available from 1997–2002.

The Upper Buffalo Wilderness contains 10,819 acres around the headwaters of the Buffalo National River in northern Arkansas. Terrain is rugged, steep valleys with many caves, hollows, and bluffs. The Upper Buffalo IMPROVE site is located on hilltop at an elevation of 723 meters (m) (2,372 ft), 500 m east of the small town of Deer, 16.5 kilometers (km) east of Upper Buffalo Wilderness boundary, and 4 km north of Hurricane Creek Wilderness boundary. The average $PM_{2.5}$ mass concentration measured at Upper Buffalo during 1997-2002 is 9.5 micrograms per cubic meter (µg/m3). The average total light extinction coefficient (Bext) is 75.5 millimeters (mm) to 1 (Visual Range approximately 52 km; Deciview approximately 20.2). The average contributions of the major aerosol components to Upper Buffalo haze are particulate sulfate 50.6 percent; nitrate 13.1 percent; organic matter (OMC) 12.7 percent; elemental carbon (light absorbing carbon [LAC]) 4.2 percent; fine soil 1.1 percent; and coarse mass (CM) 5.1 percent. Trend plots from the IMPROVE monitoring site at Upper Buffalo show that for the 20 percent worst visibility days, the extinction values are decreasing and visibility is improving (Figure 3-7). The 20 percent best visibility days are showing similar improvements (http://vista.cira.colostate.edu/views/) (Figure 3-8).

However, the Regional Haze Rule, a regulation aimed at reducing haze-forming pollutants in federally mandated Class I Areas, is concerned mainly with improvements on the worst visibility days, and maintaining visibility on the best days. The trend plots below show visibility data measured in inverse mega meters. A low measurement constitutes minimal light extinction and thus a good visibility day; a high measurement constitutes high light extinction and thus a poor visibility day. Further reductions in air pollutants impacting visibility will occur under the Regional Haze program and natural background visibility should be achieved by 2064.

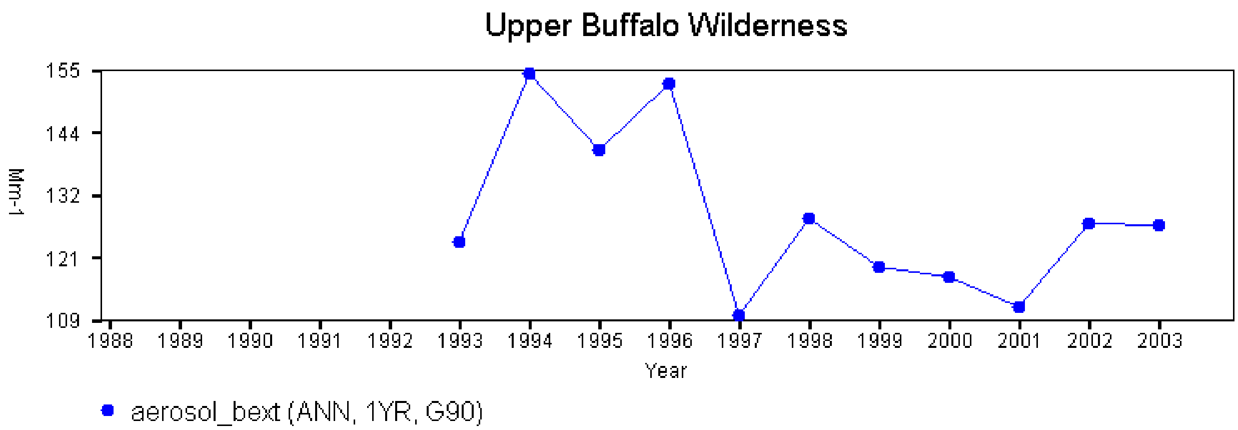

Figure 3-7: Light Extinction Monitored at Upper Buffalo on the 20% Worst Days (IMPROVE data).

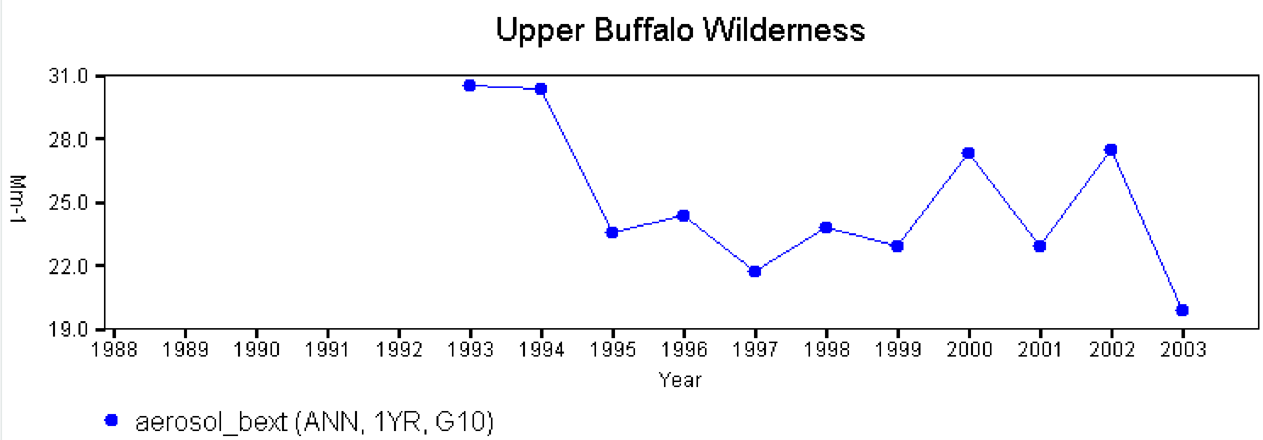

Figure 3-8: Light Extinction Monitored at Upper Buffalo on the 20% Best Days (IMPROVE data).

Nitrogen Oxides

More than 95 percent of NOx emissions are in the form of nitric oxide. The primary source of NOx emissions is the transportation sector. Point sources such as coal-burning electric generation facilities also contribute ambient NOx levels. Smoke from wild and prescribed fire is also a contributor to NOx production, and is a concern for federal land managers. However, it should be noted that thermal NOx production increases with increased burn temperature. Relatively low-temperature prescribed burns emit very little NOx as compared to wildfires. When trapped in sufficient quantities, nitrogen dioxide can be seen as a brownish haze. Secondary pollutants formed from nitrogen oxides such as nitrates also reduce visibility and contribute to acid deposition. In the presence of VOCs and sunlight, nitrogen oxides rapidly contribute to the formation of ozone. Available evidence suggests that nitrogen oxides are a controlling factor in the formation of ground-level ozone in rural areas of the southern United States (Chameides and Cowling, 1995).

Ozone

As stated above, ground level ozone (O_3) is a secondary pollutant, and its production is highly dependent on the presence of nitrogen oxides and VOCs in the right ratios; sunshine; and elevated temperatures. Therefore, high ozone levels will occur only during periods of warm weather, plentiful sunshine, and high levels of ozone-forming pollutants. For this reason, the ozone-monitoring season extends from April to October. It is important to note that there are two locations in the atmosphere where ozone occurs, the stratosphere (upper atmosphere) and the troposphere (ground level). Although the presence of ozone in the upper atmosphere is highly beneficial, in larger doses at ground level, ozone is considered a free radical capable of killing living tissue in plants and in the human lung. Ozone's harmful effects are due to the pollutant's chemical make-up. The compound ozone is composed of three oxygen molecules, and is less stable than diatomic oxygen (the oxygen our bodies need). This unstable molecule reacts with the tissues inside the leaf of a plant, sometimes causing the death of those tissues. This same ozone radical also reacts with tissues in the human lung causing inflammation and respiratory ailments, and in extreme cases, premature death. The NAAQS for ozone is set at levels considered protective of human health; however, damage to plants occurs at levels below the NAAQS for ozone. The ozone standard for human health is set at a 3-year average of 0.085 parts per million (ppm) for a rolling 8-hour average, but injury to sensitive plants can occur at levels below the standard.

The 0.085-ppm standard for ozone is a new standard, which was promulgated in July 1997 (CAAA sec 50.10). Attainment of the ozone NAAQS is based upon a three-year average of the fourth highest daily 8-hour running average. Areas that have an EPA Federal Reference Method (FRM) ozone-monitoring site must meet these criteria; otherwise, the area is designated non-attainment for ozone. However, areas that do not have a FRM ozone-monitoring site are designated as unclassifiable. Therefore, statewide attainment of the NAAQS is sometimes only as certain as the extent of the monitoring network. There are nine FRM ozone-monitoring sites in five different counties in Arkansas. Of these five counties, three contain NFS lands. The two monitors that are located adjacent to NFS lands have not exceeded the ozone standard in the 11 years they have been in operation. Except for 1998 and 1999, they have only shown minimal potential for damage. In 1998, the 8-hour annual average for ozone was 0.071 ppm with only 1 hourly occurrence where the level was greater than or equal to .100 ppm. This represents a growth loss of 2.1 percent for black cherry, which is one of the most sensitive species to ozone. In 2001, the 8-hour annual average for ozone was 0.078 ppm with only 2 occurrences where the level was greater than or equal to .100 ppm. This represents a growth loss of 3.4 percent for black cherry.

Particulate Matter

PM refers to any suspended atmospheric particle and is comprised of many different elements or compounds. It is defined based on various size classes of the particle's aerodynamic diameter, i.e., particles with an aerodynamic diameter of 10 microns are referred to as PM_{10} and particles with an aerodynamic diameter of 2.5 microns

are referred to as $PM_{2.5}$. PM can be either a primary or a secondary pollutant, both of which affect forest resources. Primary particulates tend to be larger, and are directly emitted from a combination of sources including combustion sources, agriculture, and road construction. Secondary fine particles are formed when combustion gases are chemically transformed into particles. The bulk of regional fine particles within the analysis area is the result of these chemically transformed combustion gases such as sulfates and nitrates; but mainly sulfate particles (transformed SO_2) from coal-fired power plants. These smaller, chemically transformed fine particles are largely responsible for regional haze.

While primary and secondary sources of PM outside the Forests have a major impact on air quality, Forest Service activities also can affect air quality. Smoke emitted from forest fires, both prescribed and wild, is a major concern in terms of forest activities that have the potential to affect air quality. Soot particles from wildland fires are a small, but significant part of the total $PM_{2.5}$ load. The Revised Forest Plan prescribes smoke management standards and guidelines that would minimize the impacts of smoke from prescribed burning on smoke-sensitive sites.

There are NAAQS for both PM_{10} and $PM_{2.5}$. The $PM_{2.5}$ standard is newer and more stringent. It is the standard of concern since particles with a diameter of 2.5 microns or less have a greater ability to impair visibility and impact human health. The NAAQS for $PM_{2.5}$ is a 24-hour average of no greater than 65 micrograms/m^3, or an annual arithmetic mean of no more than 15 micrograms/m^3. Currently, no areas near the Forests have been designated as non-attainment for fine particulate matter.

Summary

Air quality data are collected for various pollutants in areas around the Forests. We have not found that regional sources of air pollution are having an adverse affect on forest resources. However, visibility in the eastern part of the State has been reduced from a natural background range of 90 to 130 kms to an average visual range of 30 to 40 kms. Ozone symptoms have been documented on the foliage of ozone-sensitive species such as black cherry and blackberry. Ozone damage has not been documented. A potential growth loss of 2 or 3 percent on black cherry (the most sensitive species) is very minimal. Given these impacts currently discussed on the OSFNFs, air quality in the region can be labeled as good.

Environmental Consequences

Resource Protection Methods

Prescribed fire is the main management activity on the Forests that can affect local and regional air quality. However, the current National Fire Plan and the Healthy Forest Initiative direct the FS to utilize prescribed fire more frequently. Despite potential air quality effects from prescribed fire, it can provide important and necessary ecological benefits in forested landscapes. EPA recognized these ecological benefits and developed the Interim Air Quality Policy on Wildland and Prescribed Fires (US EPA, 1998) in an effort to help states implement smoke

management programs in cooperation with federal and other land management agencies. This policy provides incentive and guidance to states for developing smoke management programs for dealing with the NAAQS and emissions from prescribed fires, while allowing burning programs to continue. Arkansas is in the process of finalizing a Smoke Management Program, and the Forests have been involved in the process. In addition to complying with the Arkansas Smoke Management Program, the Forests will continue to utilize smoke management techniques to promote public welfare, protect smoke sensitive areas, and to meet the NAAQS. Revised forest-wide management direction states that the Forests will use best available smoke management techniques.

Section 176 (c) of the CAA prohibits Federal agencies from engaging in or supporting any activity to bring an area back into attainment that does not conform to the State's Implementation Plan. As stated previously, there are currently no counties that contain or are adjacent to NF lands that are in non-attainment status

Public Health- To protect public health, EPA and states designate concentration levels for the criteria pollutants. Federally designated maximum concentration levels are called National Ambient Air Quality Standards (NAAQS) and are defined as the amount of pollutant above which detrimental effects to public health (welfare) may result (Table 3-15). NAAQS are set at a conservative level with the intent of protecting even the most sensitive members of the public including children, asthmatics, and people with cardiovascular disease. If an area violates the NAAQS, that area becomes federally designated as a "non-attainment" area. An area that was once in non-attainment, but has since met the NAAQS and other requirements, is called a maintenance area.

Table 3-15: National and State Ambient Air Quality Standards.

Pollutant	Time Period Average	Federal Standard
Carbon Monoxide (CO)	1 hour, 8 hours	35_1 ppm, 9 ppm
Lead (Pb)	Calendar Quarter 90-day	1.5_2 $\mu g/m^3$
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean Hourly Average	0.053 ppm
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean, 24-hour, 3-hour/Hourly Average	0.03 ppm, 0.14 ppm, 0.50 ppm
Ozone (O_3)	8 hour, Hourly Average	0.12 ppm, 0.08 ppm
PM_{10}	Annual Arithmetic Mean, 24-hour	50 $\mu g/m^3$, 150 $\mu g/m^3$
$PM_{2.5}$	Annual Arithmetic Mean, 24-hour	15 $\mu g/m^3$, 65 $\mu g/m^3$

ppm – parts per million
$\mu g/m^3$ - micrograms per cubic meter

Criteria pollutants such as sulfur dioxide and nitrogen dioxide are of concern because of their potential to cause adverse effects on plant life, water quality, aquatic species, and visibility. However, sources of these pollutants are generally associated with urbanization and industrialization rather than with natural resource management activities or wildfire. Wildfire and natural resource management activities such as timber harvest, road construction, site preparation, mining, and fire

use can generate ozone, carbon monoxide, and particulate matter. While ozone is a byproduct of fire, potential ozone exposures are infrequent (Sandberg and Dost 1990). Carbon monoxide is rapidly diluted at short distances from a burning area, as fires are generally dispersed spatially and temporally, and pose little or no risk to public health (Sandberg and Dost 1990). The pollutant of most concern to public health and visibility within and downwind of the analysis area is particulate matter. Even though particulate matter has no serious effects on ecosystems because fire and smoke are ecological processes (ICBEMP 2000a), it does affect human health and visibility. Because of its smaller size, $PM_{2.5}$ poses greater health risks than PM_{10}. Fire can produce large volumes of particulate matter, which depending on meteorological conditions, may affect large areas for extended periods.

Each day, concentrations of various air pollutants are measured in areas across the states. After the amount of pollution is measured, it is compared to the federal standard. To make it easy to compare all the different pollutants and determine the air quality, the EPA (US EPA June 2000) developed the Air Quality Index (AQI) to relate all criteria pollutants to the same scale (see Table 3-16).

Table 3-16: EPA's Air Quality Index (AQI) for Particulate Matter 2.5 ($PM_{2.5}$) including the breakpoints of $PM_{2.5}$ Concentrations for the Air Quality Index Rankings.

$PM_{2.5}$ 24-hr Avg. Concentration ($\mu g/m^3$)	Index Values	Visibility (Miles)	Level of Health Concern	Cautionary Statements
0.0–15.4	0-50	> 10	Good	None
15.5–40.4	51–100*	5.1–10.0	Moderate	None
40.5–65.4	101-150	3.1–5.0	Unhealthy for Sensitive Groups	The elderly, children, people with respiratory conditions or heart disease should limit prolonged exertion.
65.5–150.4	151–200	1.6–3.0	Unhealthy	The elderly, children, people with respiratory conditions or heart disease should avoid prolonged exertion; everyone else should limit prolonged exertion.

***An AQI of 100 for $PM_{2.5}$ corresponds to a $PM_{2.5}$ level of 40 micrograms per cubic meter (24-hr avg.)**
$\mu g/m^3$- micrograms per cubic meter
EPA developed the health indices based on 24-hour averages.

Table 3-16: EPA's Air Quality Index (AQI) for Particulate Matter 2.5 ($PM_{2.5}$) including the breakpoints of $PM_{2.5}$ Concentrations for the Air Quality Index Rankings. (Continued)

$PM_{2.5}$ 24-hr Avg. Concentration (μg/m³)	Index Values	Visibility (Miles)	Level of Health Concern	Cautionary Statements
150.5–250.4	201–300	1.0–1.5	Very Unhealthy	The elderly, children, people with respiratory conditions or heart disease should avoid any outdoor activity; everyone else should avoid prolonged exertion.
250.5+	301-500	< 1.0	Hazardous	Everyone should avoid any outdoor exertion; the elderly, children, people with respiratory conditions or heart disease should remain indoors.

***An AQI of 100 for $PM_{2.5}$ corresponds to a $PM_{2.5}$ level of 40 micrograms per cubic meter (24-hr avg.)**
μg/m³- micrograms per cubic meter
EPA developed the health indices based on 24-hour averages.

Table 3-17 displays the 24-hour AQI breakpoints for PM_{10} and $PM_{2.5}$. When concentrations reach "Unhealthy for Sensitive Groups", cautionary statements are issued to suggest that the elderly, children, people with respiratory conditions or heart disease, and those who work, exercise, or spend time outdoors should limit prolonged exertion.

Table 3-17: The 24-Hour Air Quality Index (AQI) and Particulate Matter PM_{10} and $PM_{2.5}$ Breakpoints.

AQI Value	Level of Health Concern	PM_{10} Breakpoints (μg/m³)	$PM_{2.5}$ Breakpoints (μg/m³)
0-50	Good	0-54	0-15.4
51-100	Moderate	55-154	15.5-40.4
101-150	Unhealthy for Sensitive Groups	155-254	40.5-65.4
151-200	Unhealthy	255-354	65.5-150.4
201-400	Very Unhealthy	355-424	150.5-250.4
> 400	Hazardous	> 424	> 250.5

μg/m³ - micrograms per cubic meter

While the NAAQS evaluate smoke impacts related to public health, smoke often causes public concern at levels below the NAAQS. One study compared the number of complaints about smoke to the measured PM_{10} concentrations (Acheson et al. 2000). Complaints increased when PM_{10} concentrations were as low as 30 micrograms per cubic meter. The 24-hour threshold for the PM_{10} NAAQS is 150

micrograms per cubic meter (Table 3-17). The Air Quality Index for a concentration of 30 micrograms per cubic meter would be rated as "Good" indicating no health concerns (Table 3-17).

Visibility Impairment (Mandatory Class I Areas) – Class I Areas are set aside under the CAA to receive stringent protection from air quality degradation. Mandatory Class I Areas are those with certain federal designations in existence prior to the 1977 amendments to the CAA. These include:

- International parks
- National wilderness areas that exceed 5,000 acres in size
- National memorial parks that exceed 5,000 acres in size
- National parks that exceed 6,000 acres in size

The 1977 amendments to the CAA established a national goal of "the prevention of any future, and the remedying of any existing impairment of visibility in Mandatory Class I (federal) Areas in which impairment results from manmade air pollution." Fine particles ($PM_{2.5}$) are the primary cause of visibility impairment in Class I Areas although gases also contribute. Visual range is one indicator of pollution concentrations in the air. Visibility variation occurs because of the scattering and absorption of light by particles and gases in the atmosphere. Without pollution effects, an estimated natural visual range is 90 miles in the eastern U.S. and up to 140 miles in the western U.S. (US EPA November 2001).

In 1980, EPA's visibility regulations were developed to protect Mandatory Class I Areas from human-caused impairments reasonably attributable to a single or small group of sources. In contrast, EPA proposed in 1997 a new regulatory program to protect Mandatory Class I Areas from visibility impairment produced by a multitude of sources that emit fine particles and their precursors across a broad geographic area. This Regional Haze Rule (40 CFR, Part 51) addresses impacts from numerous and broad based sources that cannot be easily pinpointed. The rule calls for states to establish goals for improving visibility in Mandatory Class I Areas and to develop long-term strategies for reducing emission of air pollutants that cause visibility impairment. Fire use is one of the sources addressed by the regulations.

Interim Air Quality Policy on Wildland and Prescribed Fires

On May 15, 1998, the EPA issued the *Interim Air Quality Policy on Wildland and Prescribed Fires* (referred to as the *Interim Policy*) to address impacts to public health and welfare. This policy was prepared in response to anticipated increases in fire use that were expected to occur as a result of implementing the 1995 *Fire Management and Policy Review*, which outlined a need to restore fire as an ecosystem process into many wildlands. The *Interim Policy* was prepared in an effort to integrate the goals of using fire in its ecological role for maintaining healthy ecosystems, and mitigating its impacts of air pollutant emissions on air quality and visibility. The policy was developed with the active involvement of stakeholders including the U.S. Department of Agriculture. The *Interim Policy* is federal policy that reconciles the competing needs to use fire and maintain clean air to protect public

health and welfare. The *Interim Policy* is currently considered temporary only because it does not yet address agricultural burning on regional haze (US EPA 1998). It is not temporary (interim) with regard to how states, tribes, and federal land managers are expected to address smoke from prescribed fires.

The *Interim Policy* suggests that air quality and visibility impact evaluations of fire activities on federal lands should consider several different items during planning (US EPA 1998). Those items appropriate for a programmatic scale evaluation were considered and addressed within practical limits. Items discussed in detail in this EIS include a description of applicable regulations, plans, or policies; identification of sensitive areas (receptors); and the potential for smoke intrusions in those sensitive areas. Other important considerations discussed are applicable smoke management techniques, participation in a basic smoke management program, and potential for emission reductions. Two *Interim Policy* planning items mentioned below in this section will not be explained to the same level of detail as those listed above. These are ambient air quality and visibility monitoring plans, and the cumulative impacts of fires on regional and sub-regional air quality. In addition to these listed items, issues regarding public (transportation) safety are also discussed.

Smoke Management Program – The *Interim Policy* calls on states (and tribes) to develop smoke management programs and it instructs federal land managers to participate in them. Basic elements of a smoke management program include:

- A process to authorize burns.
- A requirement that land managers consider alternatives to burning to reduce air pollutant emissions.
- A requirement that burn plans include smoke management components such as actions to minimize fire emissions; evaluation of smoke dispersion; actions that will be taken to notify populations and authorities prior to burns to reduce the exposure of people in sensitive areas if smoke intrusions occur; and air quality monitoring, especially in sensitive areas.
- A public education and awareness program.
- A surveillance and enforcement program.
- Periodic review of its program for effectiveness.

In exchange for states (and tribes) proactively implementing smoke management programs, EPA intends to exercise its discretion not to redesignate an area as non-attainment if convincing evidence shows that fire use caused or contributed to violation of the daily or annual PM_{10} or $PM_{2.5}$ standards. The state (or tribe) must certify to EPA that at least a basic program has been adapted and implemented.

Alternatives To Burning And Emission Reductions - Even though the *Interim Policy* acknowledges that fire is a necessary and non-replaceable treatment to meet certain objectives, land management agencies are encouraged to consider whether there are alternatives to burning in order to reduce emissions. In general, mechanical treatments are considered the most viable means of reducing emissions. In some ecosystems, however, chemicals may be an option. The *Interim Policy* acknowledges

that considering alternatives to burning is not without tradeoffs and limitations. The policy states that mechanical opportunities are most normally limited to:

- Accessible areas (those with roads, harvest systems, etc).
- Terrain that is not excessively rough.
- Slopes equal to or less than 40 percent.
- Areas not designated as National Parks or Wilderness.
- Areas without listed species.
- Areas without cultural or paleological resources.

In addition to the items listed above, Forest Plan direction including land allocations, desired conditions, goals, objectives, standards, and guides may also limit opportunities for mechanical treatments.

Effects Common to All Alternatives

The level of prescribed fire use is expected to increase under Alternatives B through E, respectively. However, the level of increase varies among these alternatives. The level of prescribed fire use is expected to remain at current levels under Alternative A. Despite the varying levels of prescribed fire usage, all wildland fires result in pollutant emissions, which can impact air quality on and off the Forests. Fine particulate is the major pollutant of concern emitted from prescribed fires and is a criteria pollutant regulated under the CAA. As described previously, fine particulates are a concern in terms of human health and visibility impairment. To a lesser extent, prescribed fires emit nitrogen oxides, which are precursors to ozone formation and are regulated as a surrogate for ozone. Though both VOCs and NOx contribute to ozone formation, NOx is the limiting factor in ozone production. Because of this, NOx emissions from prescribed fires in addition to PM emissions will be assessed in this analysis. Again, it must be stressed that thermal NOx production increases with increased burn temperature. Relatively low-temperature prescribed fires emit very little NOx as compared to wildfires. Prescribed fire situations provide land management agencies with the opportunity to minimize the impacts of smoke on local communities, while a wildfire situation does not typically afford such an opportunity. Ozone is of concern from April through October. During these times the Forests burn very few acres. There would be no impacts from ozone for any of the alternatives.

Sensitive Areas

Air quality sensitive areas include places that may experience smoke related impacts to health, visibility, and public (transportation) safety. For this EIS, population centers, impact zones, non-attainment areas/maintenance areas, Class I Areas, and major travel routes and airports were considered as sensitive areas appropriate to address for this coarse-scale analysis. All of these types of areas are represented within the 100-km area of consideration. Non-attainment and Mandatory Class I Areas are designated through federal and state processes. Other sensitive areas have been identified through other processes. Evaluation of smoke impacts during finer scale or

project-level analysis may include other types of sensitive areas such as hospitals, airstrips, and campgrounds, but these are too fine-scale to be evaluated for this EIS.

Public Health – There are no non-attainment/maintenance areas in this area of consideration, which means NAAQS has not been exceeded and there is no public health risk. There are no public health concerns for any of the alternatives except Alternative C. In addition, wildfires would have the magnitude to contribute to existing pollutant levels in these areas to cause a public health risk.

Public (Transportation) Safety – Public safety, which considers the impacts of smoke on transportation safety including roads and airports, is another potential concern. Smoke can affect visibility on roads creating hazardous conditions for travelers. Smoke can be especially hazardous in low-lying areas where fog can form, further reducing visibility. Several traffic accidents have occurred on highways the southeast U.S. from visibility reductions due to smoke. Hazy conditions can also affect aviation operations at airports by reducing visibility. There are several primary travel routes (e.g., highways) and airports throughout the area of consideration. Potential impacts of smoke effects on visibility and impacts to transportation safety depend on amount, timing, and location of fire use, and the meteorological conditions that influence dispersion. Potential effects of smoke on specific areas related to transportation safety cannot be evaluated at this scale because of the spatial and temporal nature of this concern. They will not be discussed or analyzed further in this document. Mitigations for these areas are considered as part of project-level planning and implementation.

Direct and Indirect Effects by Alternatives

Prescribed Fire Emissions

Because prescribed fire activity on the OSFNFs has been moderate in the past, the need to increase the number of acres treated with prescribed fire is understood, but site-specific burn units have not been identified within the scope of this large-scale assessment. The areas on the Forests that are most suitable for and in most need of prescribed fire treatments were identified based on historic fire activity and best estimates of the fire regimes for the forest landscape and current condition classes of these fire regimes.

Areas in Condition Class 3 are considered the furthest from the natural fire cycle while those in Condition Class 1 are more or less within the natural cycle. Prescribed fire activities will be concentrated in the areas that are in Condition Classes 2 and 3.

As more acres are restored to Condition Class 1 in ecological communities adapted to low-intensity periodic fire (Fire Regime 1), the woodland condition is expected to prevail over a larger part of the landscape. In this condition, surface fuels are the primary component contributing to fire behavior. This would represent a change in current fuel profiles where surface, aerial, and ladder fuels can all contribute to fire behavior. The woodland types would include a more "grassy" fuel component (Fuel Model 2) as compared to the closed canopy forest fuel type (Fuel Model 9). In the

woodland condition, total fuel loading would be less than in the forest condition (as much as half the current average fuel loading in tons per acre). There would not be as much of a woody live and/or dead fuels component to contribute to either flaming or smoldering fire behavior. In prescribed burns and wildfires, the grassy component would burn easier and quicker and produce fewer emissions (both in concentration and duration) as compared to current fuel conditions. Fire intensity would be less in the woodland condition and there would be less likelihood (risk) of stand-replacement burns. Suppression efforts would be less costly while providing a higher degree of safety to both the public and firefighters.

Management prescriptions were assessed in conjunction with the condition class categories to determine the relative number of acres suitable for prescribed burning within each alternative based on its management emphasis. Using this number, an estimate of potentially treatable acres was developed for each alternative.

Emissions estimates per acre burned in each alternative were derived using the First Order Fire Effects Model (FOFEM, Version 5.00; Rocky Mountain Research Station). This emissions estimate was then multiplied by the number of acres that would be burned each year in each alternative to get an annual emissions estimate. To assess air quality effects, these annual emissions estimates from prescribed fire have been compared to regional annual emissions (all counties within 50 kms of the OSFNFs) in tons per year. It is important to note that the number of acres treated with prescribed fire annually is highly dependent on weather and climatic conditions among other local factors. Because there is no way to predict where and when individual prescribed burns will occur, this analysis broadly assumes that the same number of acres will be treated with prescribed fire annually at the maximum level for each alternative. In reality, there would likely be some years with little prescribed fire activity while others may be much closer to the maximum annual estimate.

The regional emissions data were obtained from the most recent and accurate emissions database available. Currently, this is the 2002 Visibility Improvement State and Tribal Association of the Southeast (VISTAS) base case emissions database. It can be assumed that if predicted emissions from the proposed prescribed fire activities contribute a small enough percentage to the total pollution load, they would not impact attainment of the NAAQS. Most counties within 50 kms of the OSFNFs are either in attainment or in unclassifiable status.

Because site-specific burn units have not been identified within the scope of this large-scale assessment, fuel-loading characteristics are unknown at this time. For this reason a range of fuel loading characteristics that were deemed representative of portions of the Forests with potentially treatable acres were used in the emissions analysis. Fuel loading characteristics for more mesic sites with mixed oak and hardwood species were modeled to represent the treatable acres on the north slopes of the Forests, and fuel loading characteristics for dryer mixed oak and chestnut oak sites were modeled to represent the south slopes.

Alternative Comparison - Emission estimates per acre burned were derived from the FOFEM model. The number of acres burned varied by alternative; thus, the prescribed fire annual emissions also varied. Under Alternative A, the maximum prescribed fire usage is expected to remain at the current level of 70,000 acres a year. Under Alternative B, prescribed fire usage would increase to a maximum 80,000 acres per year. Under Alternative C, the prescribed fire acreage would be approximately 150,000. Alternatives D and E would have 90,000 and 120,000 acres burned a year, respectively. The results for each alternative are presented in Table 3-18 for $PM_{2.5}$.

Table 3-18: $PM_{2.5}$ Estimated from Prescribed Burning (Percent Increase over Current Plan Prescribed Fire Projections).

Evaluation Criteria	Alternatives				
	A	B	C	D	E
Prescribed Burn Acres	70,000	80,000	150,000	90,000	120,000
Tons of $PM_{2.5}$ Produced from Prescribed Burning	4640—5692	5302—6506	9942—12198	7319—7540	7954—9758

The Forests will use the best available smoke management techniques and technology to alleviate human health impacts or nuisance of smoke in local communities and smoke sensitive areas, and avoid impacting attainment status for any criteria pollutant in areas where burns are conducted.

Cumulative Effects

Because EPA has not been tracking $PM_{2.5}$ emission for very long, and it appears that the FS emissions have not been included in the emissions inventory, a more accurate description of the percentage increase from Regional Emissions would be to compare the PM_{10} emissions. EPA has been tracking this pollutant for almost 15 years and the emissions inventory for this pollutant appears to be more accurate. Table 3-19 compares the cumulative emission estimates for $PM_{2.5}$ and PM_{10} emissions. Other than the proposed increases in Forest Service prescribed burning listed in Table 3-18, there are no expected increases (above background) in burning in the analysis area.

Table 3-19: Cumulative emission estimates for $PM_{2.5}$ and PM_{10} for Management Activities on the OSFNFs.

Emission Data	Alternatives				
	A	B	C	D	E
	$PM_{2.5}$ Emissions				
OSFNFs Management Emissions (Tons per Year)	5,692	6,506	12,198	7,319	9,758
Total Regional Emissions (Tons per Year)	89,512	89,512	89,512	89,512	89,512
% Prescribed Fire of Total Regional Emissions	6%	7%	14%	8%	11%

Table 3-19: Cumulative emission estimates for $PM_{2.5}$ and PM_{10} for Management Activities on the OSFNFs. (Continued)

Emission Data	Alternatives				
	A	B	C	D	E
	PM_{10} Emissions				
OSFNFs Management Emissions (Tons per Year)	6,716	7,675	14,391	8,634	11,513
Total Regional Emissions (Tons per Year)	327,619	327,619	327,619	327,619	327,619
% Prescribed Fire of Total Regional Emissions	2.0%	2.3%	4.4%	2.6%	3.5%

MINERALS

Affected Environment

The OSFNFs encourage, facilitate, and administer the exploration, development, and production of mineral resources, while providing for the conservation and protection of surface resources. Mineral activities are encouraged in accordance with various mining and leasing acts, and applicable federal and state statutes governing protection of the environment. This includes air and water quality standards applicable to these activities.

The majority of the NF lands on the OSFNFs were acquired through land purchase or exchange. In some instances, the minerals were outstanding at the time the U.S. acquired the surface, in other cases, the landowner reserved the minerals as a condition of sale or exchange. As a result, the United States has varying degrees of control over surface operations related to mineral extraction, depending on the mineral ownership. There are about 1,162,559 acres of surface estate owned by the federal government, and administered by the OSFNFs. About 227,841 acres (20% of NF lands) have Public Domain (PD) surface and mineral status. These lands had never been conveyed out of federal ownership, and were later reserved for national forest purposes. The U.S. acquired, through purchase or exchange, the remaining 934,718 acres (80% of the OSFNFs).

Total federal mineral ownership under the federal surface estate is 1,031,885 acres, which is about 89 percent of the OSFNFs. An additional 2,058 acres of federal mineral ownership lie under privately owned lands within the NF boundary. This is the result of the U.S. reserving the federal mineral interests when the lands were exchanged. Responsibility for management of these reserved federal mineral interests lies with the Department of Interior, Bureau of Land Management (BLM), as the Forest Service is no longer the surface managing agency. There are 130,664 acres of federal surface within the Forests that are subject to privately owned mineral interests. This comprises about 11 percent of the forest area. Of this, 84,191 acres (7% of the federal surface) are subject to 100 percent private mineral ownership. The mineral interests under the remaining 46,473 acres of federal surface (approximately 4% of the Forests) are split between federal and private ownership, with the U.S. owning some fractional mineral interest under these 46,473 acres.

Private mineral rights can be categorized two ways:

- Outstanding rights which are mineral rights held by a third party at the time the Forest Service purchased the land from the surface owner, and
- Reserved rights, which are mineral rights reserved by the property owner at the time the surface was conveyed to the Forest Service.

Currently there are 298,438 acres (488 leases) leased for natural gas.

The geologic setting of the Forests provides a diversity of energy and non-energy mineral resources. Since approval of the 1986 Land Management Plan, minerals from the Forests (including natural gas and mineral materials) have been used to meet the basic needs of the public such as providing natural gas fuel for energy sources and heating homes; stone for construction and functional home projects, and road surfacing/maintenance materials. Development of the federal and private minerals underlying the OSFNFs stimulates the local and national economies by making available the raw materials needed for continued economic development, resulting in increased jobs and spending. The sustainability of the Forests depends on the continued use of mineral resources to meet the public's demand for fuels, building materials, etc. The role of mineral resources is fundamental to viability of human ecosystems.

The Ozark NF is located in north Arkansas within the Arkansas River Valley and the Ozark Highlands. The St. Francis NF is located in east Arkansas at the confluence of the St. Francis and the Mississippi Rivers within the Mississippi River Delta. Because the St. Francis NF is underlain by silt, clay, and sand, there are no active mineral activities or oil and gas plays or prospects being pursued on the St. Francis. Consequently, discussions on minerals activity, potential, and management in this document and in the Forest Plan are focused primarily on the Ozark NF. If oil and gas activity does take place on the St. Francis NF, the typical drilling scenario and well design as stated in the BLM Reasonable Foreseeable Development Scenario would apply.

Minerals activities on the Ozark NF are primarily associated with gas exploration and production, associated gas pipelines, and disposal of common variety mineral materials (primarily surface "building" stone and pit-run gravel). The geologic table for the geologic formations on each of the OSFNFs ranger districts and the geologic descriptions are found in Appendix F. Gas and hardrock minerals potential for all ranger districts is displayed in Table 3-20. The USDI Bureau of Land Management has provided the evaluation on the gas development for the OSFNFs titled "Oil and Gas Reasonable Foreseeable Development Scenario" in Appendix F.

Table 3-20: Gas and Hardrock Minerals Potential on the OSFNFs.

Oil & Gas And Hardrock Minerals Potential[1] on the Ozark-St. Francis National Forests				
Ranger District (RD)	**RD Geologic Formations [2]**	**Gas Exploration Potential [3]**	**Gas Production Current and Past [3]**	**Hardrock Potential [4]**
Bayou	Pbh 60%, Pa 40%	High	No	Low
Boston Mountain	Pa 90%, Pbh 8%, Phc 2%	High	Yes, (Crawford Franklin, Madison, Washington Cos.)	Low
Boston Mtn – Wedington Unit	Mbn 90%, Mfb 5%, MDc 5%	Moderate to High	No	Low
Buffalo	Pbh 60%, Pa 25%, Mpfb 8%, Phc 5%, Mb 2%	High	No	Low
Buffalo - Henry Keon Experimental Forest, Jasper	Mb 80%, Ose 10%, Mpfb 5%, Phc/Pbh 5%	Moderate	No	Low
Magazine	Pa 40%, Phs 30%, Pm 25%, Ps 5%	High	Yes (Logan Co.)	Low
Pleasant Hill	Pa 90%, Pbh 8%, Phc 2%	High	Yes (Franklin & Johnson Cos.)	Low
Sylamore	Mb 40%, Mr 5%, Ose 40%, Op 5%, Mpfp 5%, Ocj 5%	Moderate	No	Low
St. Francis	Ql 90%, Qcm 5%, Qso/Qt/Qsg 10%	Low	No	Low

[1] Minerals potential for OSFNFs. Reference to "Oil and Gas" is a standard administrative energy minerals term. Oil is not noted in central and north Arkansas. Exploration and production has been, and is currently, only for gas.
[2] Geologic formations occurring on the OSFNFs, and approximate percent of each ranger district comprised by each formation. See Appendix G, Geologic Stratigraphic Column Table for explanation of abbreviations.
[3] "Gas Exploration Potential" and "Gas Production" are from USDI Bureau of Land Management, Jackson District Office, Energy Minerals Department.
[4] "Hardrock" minerals refer to metallic and valuable non-metallic subsurface minerals, but not sand, gravel and stone (Common Variety Mineral Materials) considered part of the surface estate.

Legal and Administrative Framework

Statutory and regulatory direction separates mineral resources in the publicly owned lands of the United States into three categories: locatable, leasable, and salable. Statutes, regulations, and executive orders guide Forest Service policy governing the exploration and development of mineral activities on National Forest System lands. Statutory and regulatory direction for mineral resources on the OSFNFs can be found in Appendix F.

Lands Statutorily Unavailable for Mineral Leasing or Permit are as follows:

- Subject to valid existing rights, the minerals in lands designated under the Wilderness Act of September 3, 1964, are withdrawn from all forms of disposition under all laws pertaining to mining and mineral leasing. The Ozark NF has five congressionally designated wilderness areas (East Fork, Hurricane Creek, Leatherwood, Richland Creek, and Upper Buffalo) for a total of approximately 66,728 acres, which are statutorily withdrawn from leasing. Currently, there are no issued federal mineral leases or permits within the designated wilderness areas.
- Subject to valid existing rights, the minerals in federal lands that constitute the bed or bank, or are situated within one-quarter mile of the bank of any river congressionally designated a "wild river" are withdrawn from operation of the mining and mineral leasing laws. This restriction does not apply to those segments of a wild and scenic river that are designated as "scenic" or "recreational." The Ozark NF has six congressionally designated rivers. These rivers are displayed in Table 3-154 in the "Wild and Scenic River" portion of this report.

Federal Minerals Management

Locatable Minerals

The General Mining Law of 1872 (U.S. Mining Laws, Act of May 10, 1872) applies to all mineral deposits in National Forest System lands reserved from the public domain. Where public domain lands have been formally withdrawn, no authority exists to explore for, or develop, locatable minerals on those lands. Minerals such as metallic minerals that would be locatable minerals on public domain lands are hardrock leasable minerals on acquired lands. Leasing act minerals such as oil, gas, and coal and other leasing act minerals and mineral materials (including, but not limited to sand, gravel, and building stone) are regulated by other laws and regulations. There is one mining claim exploration activity on the Ozark NF. The operation is for shallow trenching with a backhoe in a one-quarter (1/4) acre area.

The proposal was evaluated by the Bayou District Ranger in 2004 and approved under a decision memo (Table 3-21).

Table 3-21: Mining Claim on Bayou Ranger District.

Ranger District	Legal Description	Acres
Bayou	T11N R20W Section 11	0.5

In order to protect valuable surface resources for special sites and areas like administration and recreation sites, some Public Domain status lands are withdrawn from locatable mineral entry for administrative purposes. A review of mineral withdrawals was conducted to determine if withdrawals on the Ozark NF should remain in effect or recommended for removal (there are none on the St. Francis NF). The USDI Bureau of Land Management is the lead federal agency for monitoring and

managing administrative mineral withdrawals. The withdrawals do not affect leasable energy and common variety disposals unless so stated in the withdrawal authority. The mineral withdrawal review is in minerals Appendix F.

Leasable Minerals

National Forest System lands are generally available for exploration and mining unless specifically precluded by an act of Congress or other formal withdrawal. Which mineral-leasing act applies depends on the type of lands and minerals involved. The revised Forest Plan identifies those areas that are available and unavailable for energy and non-energy exploration and leasing. For non-energy leasable minerals, public scoping and a site-specific analysis are completed by the FS upon BLM's receipt of a permit or preference right lease application. This is done prior to issuance of the permit or lease. BLM cannot issue a permit or lease on hardrock leasable minerals without the consent of the Regional Forester.

For energy leasable minerals (i.e. oil, gas, and coal-only gas is on the OSFNFs), the revised Forest Plan makes both the land availability decision, and the consent to lease. Lands where the minerals are statutorily withdrawn from leasing are identified in the revised Forest Plan. Public scoping and site-specific analysis of energy leasable mineral development will be completed when the BLM and the Forest Service receive a Notice of Staking (NOS) or an Application for Permit to Drill (APD).

All leases and permits will be administered to standard in accordance with Washington Office policy. The OSFNFs will, at minimum, document annually the lessee/permittees on the ground activities in compliance/non-compliance with the approved surface use plan of operations or terms of the permit.

Leasable Minerals - Hardrock (Non-Energy)

On acquired lands, a federal prospecting permit or preference right lease issued by the USDI Bureau of Land Management authorizes the exploration and development of hardrock minerals, such as gold and silver. A party desiring a prospecting permit makes an application to the appropriate BLM office, which is then forwarded to the Forest Service, along with a request for consent to issuance of the permit. The Forest will do a mineral ownership determination and then contact the applicant to get a detailed exploration plan to complete the scooping and environmental analysis of the project. Based on the review of the Forest Plan and NEPA analysis the Regional Forester either consents or denies consent to issuance of the prospecting permit by the BLM. Hardrock prospecting permits have an initial term of two years, with the option of a four-year renewal.

If the permittee believes that a valuable deposit exists, he/she may apply to the BLM for a 20-year preference right lease. The BLM will make an independent economic analysis to verify the commercial potential of the deposit. If the BLM believes the deposit can be mined, milled, and sold at a net profit, they will request Forest Service consent to issuance of the preference right lease. At this point, the Forest Service will complete another environmental assessment of the proposed mining operation. Even

though a valuable deposit of minerals has been found, the Forest Service could deny consent to issuance of the preference right lease based on the environmental analysis and other factors.

All permits will be administered to standard in accordance with Washington Office policy. OSFNFs will document the lessee/permittees on the ground activities in compliance/non-compliance with the approved surface use plan of operations or terms of the permit. The OSFNFs have no non-energy (hardrock) leases.

Leasable Minerals - Gas (Energy)

Through the passage of the 1920 Mineral Leasing Act, Congress established a program to provide for oil, gas (no oil or coal exploration or operations are on the OSFNFs), and coal development on federal lands, including national forests reserved from the public domain. This Act authorizes the Secretary of the Interior to issue leases for the disposal of certain minerals (including coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The Mineral Leasing Act for Acquired Lands of August 7, 1947, extends the provisions of the mineral leasing laws to acquired National Forest System lands and requires the consent of the Secretary of Agriculture prior to leasing. The National Forest System lands on the OSFNFs are 80 percent acquired lands. The purpose of this Act is "to promote the mining of coal, phosphate, sodium, potassium, oil, oil shale, gas, and sulphur on lands acquired by the United States." The Surface Mining Control and Reclamation Act of 1977 prohibits surface (strip) mining of coal on any Federal lands within the boundaries of any National Forest east of the 100th Meridian. Deposits of coal can only be mined by underground methods. There are no known deposits of mine able coal on the OSFNFs.

The Energy Security Act of June 30, 1980, directs the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on National Forest System lands, notwithstanding the current status of the Land and Resource Management Plan ("Forest Plan"). The federal oil and gas leases issued on the OSFNFs after 1980 were a response to this congressional direction as well as to public demand for energy resources. In accordance with the Energy Security Act, energy leases and permits will continue to be processed notwithstanding the current status of the revision of the OSFNFs' Forest Plan. As part of the Federal Onshore Oil and Gas Leasing Reform Act of 1987, Congress again recognized the Forest Service’s role concerning leasing and administration of surface operations during oil and gas development. The implementing regulations for this Act (36 CFR 228, Subpart E) provide the basis for the analysis of alternatives and decisions on federal oil and gas leasing in the Revised Forest Plan.

Executive Order 13212 (Actions to Expedite Energy-Related Projects) of May 18, 2001, states, "executive departments and agencies shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy." The Executive Order 13212 requires that: "For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections."

The federal oil and gas-leasing program helps supply the nation with critical energy minerals, and provides a source of revenue to the local, state, and federal governments. Oil and gas leases are issued primarily through a competitive bid sale process, which generates revenue from bonus bids (not less than $2.00 per acre), as well as the annual rental fees (not less than $1.50 per acre). If a producing well is drilled which produces oil and gas from lands covered by a federal lease, the federal government receives a 12 1/2 percent royalty payment based on actual production. There are instances where the normal 12 1/2 percent royalty rate could be higher (an increase in the royalty rate is a condition of reinstatement of a federal lease where rental was not paid timely) or it could be lower if the well meets the very narrow guidelines under the federal Royalty Reduction Act.

The Minerals Management Service (MMS) of the Department of Interior collects all minerals revenues generated from federal leases and permits. The MMS distributes 25 percent of the energy mineral revenues generated from acquired lands to the State of Arkansas under the authority of P.L. 60-136, 25 Percent Fund Act of 1908; in addition, the non-energy mineral receipts are distributed by the Forest Service under one of two public laws: 1) P.L. 60-136, 25 Percent Fund Act of 1908, or 2) P.L. 106-393, Secure Rural School and Community Self-Determination Act of 2000, depending on the election made by each county. In those cases where the leases involve public domain minerals, 50 percent of the mineral revenues are distributed by the MMS to the State of Arkansas.

The Forest Plan makes two decisions related to minerals: 1) availability of lands for future leasing (36 CFR 228.102[d]), and 2) consent to lease the available lands (36 CFR 228.102[e]), subject to standard lease terms, or subject to additional constraints (stipulations) as required by the prescription for a specific management area. The Forest Plan analyzes those areas of the Forests with leasing interest or mineral potential using the "Reasonable Foreseeable Development Scenario" developed by the BLM geologists (Appendix F). This study looked at the long-term (10 years) potential for natural gas development in the study area and projected the number of wells they anticipated would be drilled during the 10-year period. Under the Revised Forest Plan, the BLM will be able to issue oil and gas leases in areas where the Plan makes both the availability and the consent decision. The Revised Forest Plan’s environmental analysis and documentation for federal oil and gas is more detailed than it is for other leasable minerals because of the two oil and gas lease decisions that are made in the Plan.

Once an oil and gas lease is issued, a second round of NEPA is required prior to the lessee staking the drill site, occupying the surface, and drilling an exploratory well. Onshore Oil and Gas Order No. 1 outlines the necessary requirements for the approval of all proposed exploratory, development, and service wells. The lessee must apply to the BLM for an Application for Permit to Drill (APD) per direction in Onshore Oil and Gas Order No. 1. The APD contains two parts: the Surface Use Plan of Operations (SUPO), and the technical, "Downhole" Drilling Plan. The Forest Service, in cooperation with the BLM, completes an environmental analysis, including public involvement, of the proposed roads, wells and any other ground disturbance activities proposed in the SUPO portion of the APD. The BLM is responsible for the

review and approval of the Drilling Plan. After the environmental analysis and public involvement, the Forest Service would decide

- Whether to approve the surface use plan of operations portion of the APD,
- If so, where (assuming the proposed location has been amended to accommodate other resource needs), and
- The specific Conditions of Approval (COA).

A critical part of the approved SUPO is the required reclamation plan. Each operator proposing to develop federal minerals must post a bond with the BLM to ensure compliance with the operating and reclamation requirements. The Forest Service should review the current bond and/or bond to be furnished to ensure that the bond amount is adequate for the protection of federal lands under the jurisdiction of the Forest Service. If at any time prior to or during the conduct of operations, the authorized Forest Service officer determines the financial instrument held by the BLM is not adequate to ensure complete and timely reclamation and restoration, a request to increase the bond amount, including supporting documentation, shall be submitted to the Regional Forester. The Regional Forester will review and request that the BLM increase the bond amount, the authorized Forest Service officer will notify the operator that a separate bond instrument must be filed with the Forest Service in the amount deemed adequate by the authorized officer to ensure reclamation and restoration. The authorized Forest Service officer will notify the BLM of the separate bond instrument filed with the Forest Service.

Under the terms of a federal lease, the lessee is granted the exclusive right to drill for, mine, extract, remove, and dispose of all the leased resources, together with the right to build and maintain necessary improvements, on the leasehold. Federal oil and gas leases contain standard lease terms (SLTs), which provide that the operations must be conducted in a manner that minimizes, to the extent possible, adverse impacts to the land, air, and water; to cultural, biological, visual, and other resources; and to other land uses or users. Federal environmental protection laws such as the Clean Air Act, Clean Water Act, Endangered Species Act, and Historic Preservation Act apply to all proposed activities.

In addition, based on the management prescription for a specific area contained in the Forest Plan, the lease may have been issued subject to a stipulation that modifies the standard lease rights and is attached to and made a part of the lease. Conditions, or restrictions in the stipulations, are considered consistent with the lease rights granted, provided they do not require relocation of proposed operations by more than 200 meters, require that the operations be sited off the leasehold, or prohibit new surface disturbing operations for a period in excess of 60 days in any lease year.

There are three different nationally approved stipulation forms. They are:

- **No surface occupancy (NSO)**–Used when surface occupancy of certain lands is prohibited.

- **Timing/season**–Used to prohibit surface occupancy of certain lands during specific times, such as for protection during nesting or calving season.
- **Controlled surface use (CSU)**–Used when restrictions will apply to occupancy, such as requiring additional mitigation to resolve potential conflicting uses, or to meet visual quality objectives.

A lease may also be issued subject to a lease notice (LN). A notice does not contain any new restrictions. It simply puts the lessee on "notice" that his operations must be in compliance with the applicable statute(s), such as the Endangered Species Act, if applicable at the time surface occupancy is proposed. In addition to the two lease stipulations that may be required, there are two LNs that can be used:

- **Lease Notice #3**, which indicates all, or part, of the leased lands may contain animal or plant species classified under the Endangered Species Act.
- **Lease Notice #4**, which indicates all or part of the leased lands may be classified as wetlands, floodplain, or riparian areas that will require special protection.

Issued leases are reviewed on the Forests to ensure inclusion of two basic stipulations. One is the Notice to Lessee (NTL) from the USDI Bureau of Land Management, states that any entity holding a coal lease cannot qualify for an oil and gas lease unless the coal lease is operating properly. The other stipulation applies to all NF lands under the jurisdiction of the Department of Agriculture and ensures general compliance with rules and regulations of the Secretary of Agriculture when not inconsistent with the rights granted in the lease.

A lessee may request a modification waiver, or one-time exception of an NSO stipulation, or any other stipulation. The Forest Service may authorize the BLM to grant the change if:

- The change is consistent with Federal law and the Forest Plan,
- Management objectives that led to the stipulation can be met following the change, and
- The environmental impact of the change is acceptable.

If the change substantially modifies the terms of the lease, public notice must be given at least 30 days before the results of an environmental analysis are approved (Federal Onshore Oil and Gas Leasing Reform Act of 1987).

In all cases where the minerals are privately owned, the Forest Service must obtain the best surface protection possible using the terms and the deed severing the subsurface from the surface estate, applicable state and federal laws (i.e. Endangered Species Act), and cooperation and negotiations with the operator.

Gas on the Ozark NF

The USDI Bureau of Land Management has provided the evaluation on the gas development for the OSFNFs titled "Oil and Gas Reasonable Foreseeable

Development Scenario" in Appendix G. On the Ozark NF, production is primarily in Johnson and Franklin counties, with some on National Forest lands in Logan, Crawford, Washington, and Madison counties. Fifteen gas wells were drilled on the Ozark NF in the prior Plan period for an average of one well per year. The Ozark NF has 1,031,885 acres of combined Federal surface and Federal mineral estates, 84,191 acres of Federal surface with private mineral estate, and 46,473 acres of Federal surface with partial Federal mineral estate ownership. There are 488 active Oil and Gas Federal leases on 298,438 acres of the Ozark NF. All the currently active gas well and related sites on the Forests are in Table 3-22.

Table 3-22: Active Gas Well Sites on the Ozark NF.

Township-North	Range-West	Section	Well Number	Operator	Lease Number or Reserved/Outstanding
6	26	4	#1-4	Hogback Exp.	ARES 49409
10	20	28	#1-28	Freedom Eng	Outstanding
11	24	8	#1-8	Seeco	Outstanding
11	24	9	#1-8	Seeco	Outstanding
11	24	17	#1-17	Seeco	Outstanding
11	25	1	#1	Weiser Brown	ARES 2495
11	25	1	#2-1	Weiser Brown	ARES 2495
11	25	1	#3-1	Weiser Brown	ARES 2495
11	25	2	#3-2	Seeco	Outstanding
11	25	3	#3-3	Weiser Brown	ARES 2495
11	25	3	#1-3	Weiser Brown	ARES 2495
11	25	3	#2-3	Weiser Brown	Outstanding
11	25	4	#1-4	Weiser Brown	Outstanding
11	25	4	#2-4	Weiser Brown	Outstanding
11	25	5	#1-5	Weiser Brown	ARES 15176
11	25	7	#1-7	Weiser Brown	ARES 33058
11	25	8	#2-8	Seeco	ARES 2495
11	25	9	#1-9	Weiser Brown	Outstanding
11	25	9	#2-9	Weiser Brown	ARES 2495
11	25	10	#2-10	Seeco	ARES 5262
11	25	10	#1-10	Seeco	Outstanding
11	25	12	#1	Seeco	ARES 5262
11	25	12	#3-12	Seeco	ARES 5262
11	25	13	#1-13	Seeco	ARES 5269
11	25	13	#2-13	Seeco	ARES 5269
11	25	14	#2-14	Seeco	ARES 5263
11	25	24	#2-24	Sedna	Reserved
11	26	2	#1-2	Hogback Exp	ARES 35088
11	26	4	#1-4	Seeco	ARES 11609
11	26	18	#2-18	Seeco	ARES 38116
11	26	18	#3-18	Seeco	Outstanding
11	27	19	#1-19	Seeco	Outstanding
11	28	12	#1-12	Seeco	ARES 46676
11	28	24	#3	Seeco	Outstanding
11	29	24	#1-24	Seeco	ARES 46684

Table 3-22: Active Gas Well Sites on the Ozark NF. (Continued)

Township-North	Range-West	Section	Well Number	Operator	Lease Number or Reserved/Outstanding
12	23	31	#1-36	Weiser Brown	Outstanding
12	23	31	#1-31	Freedom Eng	ARES 15173
12	23	31	#2-31	Freedom Eng	Outstanding
12	24	28	#1-28	Seeco	ARES 5266
12	24	32	#2-32	Seeco	ARES 4068/5277
12	24	33	#1-33	Seeco	ARES 5276
12	24	33			Separator Station
12	25	35	#1-35	Weiser Brown	Outstanding
12	25	35	#2-35	Weiser Brown	Outstanding
12	25	36	#1-36	Weiser Brown	Private Well
12	26	33	#1-33	Weiser Brown	ARES 12485
12	28	19	#3-19	Ranken	ARES 12035
12	28	19	#1-19	Ranken	ARES 12035
12	28	19		Ranken	Compressor Unit
12	28	23	#1-23	Ranken	ARES 12597
12	28	22	#1-22	Ranken	ARES 12597/12051

Gas Pipelines on the Ozark NF

Gas pipelines are essential and unique to the transport needs of the energy minerals that are produced. The Ozark NF has 14 permitted gas pipelines affecting a cumulative total 409 acres. These pipelines occupy principally road rights-of-way in linear covered and reclaimed trenches. Vegetative clearing widths vary from 10 to 60 feet. Lengths range from 50 feet to 50 miles (7 are less than ½ mile in length, 5 are from 2 to 3 miles, 1 is 17 miles and 1 is 50 miles).

Mineral Materials

The Mineral Materials Act of July 31, 1947, authorized the disposal of mineral and vegetative materials through a sale system on public lands of the United States. The act also provides for free use of these materials by federal or state agencies, municipalities, or nonprofit associations as long as those materials are not for commercial, industrial, or resale purposes. The act was amended by the Multiple Use Mining Act of July 23, 1955. This Act defined what common variety mineral materials are and distinguished them from rare varieties (uncommon variety mineral material). Mineral materials or "common variety" minerals are commodities having a low unit value/ton and include sand, gravel, crushed stone, riprap, clay, fill dirt, and building and dimension stone. These materials are used in road construction, landscaping, and as building materials. They can be sold to individuals or companies through negotiated or competitive bidding or give as free use to public agencies (e.g., county and state highway departments) for public purpose use. Any sale of mineral materials must be made at no less than fair market value. Sale of mineral materials is at the discretion of the Forests, which can choose not to do so as determined by the district ranger.

Common Variety Mineral Materials on the Ozark NF

The Forest Service administers the common variety mineral material (CVMM) program for disposals of pit-run gravel and stone. In 2003, the Forests issued 28 contracts and permits for CVMM disposals totaling 4,618 tons. The Forests disposed of another 39,420 tons specifically for Forest Service use. Table 3-23 shows the CVMM pit sites on the OSFNFs.

Table 3-23: Common Variety Mineral Material Pit Sites on the OSFNFs.

Ranger District	Legal Description	Acres
Magazine Mtn.	T6N R24W Sec.35 NWNE	1.00
Magazine Mtn.	T6N R25W Sec.1 NWNE	2.00
Magazine Mtn.	T6N R24W Sec.15 NWNW	2.00
Magazine Mtn.	T6N R22W Sec.8 NWSW	3.00
Magazine Mtn.	T7N R23W Sec.18 SWSW	3.00
Sylamore	T16N R13W Sec.22	1.20
Sylamore	T17N R21W Sec.11	3.00
Sylamore	T18N R13W Sec.22	1.50
Sylamore	T17N R13W Sec.13, 18, 19, 4	4.00
Sylamore	T16N R11W Sec.6	3.00
Bayou	NONE	0.00
Buffalo	T14N R18W sec.5	3.00
Buffalo	T13N R22W sec.19	0.50
Pleasant Hill	T11N R25W Sec.2 SESW	1.00
Pleasant Hill	T11N R26W Sec.3 NENW	1.00
Boston Mtn.	T12N R27W Sec.17	0.75
Boston Mtn.	T11N R32W Sec.33	0.75
Boston Mtn.	T12N R28W Sec.13	0.75
Boston Mtn.	T12N R28W Sec.21	0.75
Boston Mtn.	T12N R28W Sec.02	0.75
Boston Mtn.	T13N R27W Sec.20	0.75
Boston Mtn.	T12N R28W Sec.10	0.75
Boston Mtn.	T13N R28W Sec.25	0.75
Boston Mtn.	T13N R28W Sec.23	0.75
Boston Mtn.	T13N R28W Sec.17	0.75
St.Francis	NONE	0.00

Total CVMM: 24 pits–37 acres. Average: 1.53 acres/pit.

Direct and Indirect Effects

The BLM developed the Reasonable Foreseeable Development (RFD) Scenario for gas on the OSFNFs. Hardrock minerals potential is based on minerals and geology reports primarily from the State of Arkansas Geological Commission, USDI Bureau of Mines, USDI Geological Survey, and USDA Forest Service. These evaluations have been incorporated in this section. Gas and hardrock minerals potential for all ranger districts is displayed in Table 3-24 in the Affected Environment section

Locatable Minerals

In the past 20 years there have been 2 mining claim locations on the Ozark NF (none on the St. Francis NF). In the first case dating back to 1985, the claimant expressed interest in searching for diamonds. No operating proposal was submitted, and the claim was abandoned in 1986. In the second case, in 2003 a new claimant located the same site as the 1985 mining claim. Early in 2004, the claimant proposed digging several shallow surface exploration trenches. By the end of 2004, the claimant had not conducted any surface disturbing operations. A 1969 report by the USDI Bureau of Mines (Stroud, 1969, Mineral Resources and Industries of Arkansas) provides a synopsis of the minerals exploration and development history for each Arkansas County

Leasable Minerals/Non-Energy

In the past 20 years there have been two prospecting permit applications (one in the 1980s and one in early 1990s) on the Ozark NF (none on the St. Francis NF). Neither of the prospecting permits resulted in leases nor was active for longer than just a few months.

Leasable Minerals/Energy

A listing of all current producing or active gas well sites on the Ozark NF is in Table 3-26. The BLM's reasonable foreseeable development scenario (Appendix F) for oil and gas is a model or projection of anticipated natural gas exploration and/or development activity (leasing, exploration, development, production, and abandonment) in a defined area for a specified period of time (usually 10 years) on the OSFNFs. The scenario is based primarily on the subsurface geology, past development history, current activity, anticipated future demand with consideration of other significant factors, such as economics, technology, physical limitations on access, existing or anticipated infrastructure, and transportation. It is divided into a forecast primarily for the Pleasant Hill and Boston Mountain Ranger Districts where most of the production on the Ozark NF occurs (none on the St. Francis NF). In determining the oil and gas potential of the OSFNFs, the rating system outlined in BLM Fluid Minerals Handbook H-1624-1 was used. The ratings used had four levels: High, Moderate, Low, and No Potential. These are defined as:

- **High:** Geologic environments that are highly favorable for the occurrence of undiscovered oil and/or gas resources. This includes areas previously classified as known geologic structures (KGS); inclusion in an oil and gas play as defined by the United States Geological Survey (USGS) national assessment, or in the absence of a play designation by USGS, the demonstrated existence of: source rock, thermal maturation, and reservoir strata possessing permeability and/or physical evidence or documentation in the literature.

- **Moderate:** Geophysical or geological indications are favorable for the occurrence of undiscovered oil and/or gas resources. Evidence exists that one of the following may be absent: source rock, thermal maturation, and reservoir strata possessing permeability and/or porosity and traps. Geologic indication is defined by geological inference based on indirect evidence.
- **Low:** The geologic, geochemical, and geophysical characteristics do not indicate a favorable environment for the accumulation of oil and/or gas resources. Specific indications that one or more of the following may not be present: source rock, thermal maturation, or reservoir strata possessing permeability and/or porosity, and traps.
- **No Potential:** Demonstrated absence of 1) source rock, 2) thermal maturation, 3) reservoir rock that precludes the occurrence of oil and/or gas. Demonstrated absence is defined by physical evidence or documentation in the literature.

As stated in Appendix F, the Ozark NF has various natural gas potentials. "This area (Arkoma Basin) is classed as having high potential for oil and gas reserves". The minerals potential table in the Affected Environment section shows the gas potential rating as determined by the USDI Bureau of Land Management. The Bayou, Boston Mountain, Buffalo, Magazine, and Pleasant Hill Ranger Districts are rated high. The Wedington Unit of the Boston Mountain Ranger District is rated moderate to high, The Henry Keon Experimental Forest and Jasper area of the Buffalo Ranger District and the Sylamore Ranger District are rated moderate, and the St. Francis National Forest is rated low.

A map showing all currently producing gas wells in central and northern Arkansas was produced by the USDI Bureau of Land Management. The wells are primarily in the Arkoma Basin on private lands adjacent to the Ozark NF (Appendix F).

In the next 10 years, the RFD (updated Reasonable Foreseeable Development Scenario) shows the following predictions.

These figures reflect disturbance of surface over 10 federal wells and 5 wells on reserved and outstanding minerals for the planning period (1.5 wells per year). Actual road and pipeline lengths could be longer with remaining portions on other surface. Table 3-24 displays the estimated area of disturbance in acres from drilling, under a low, medium, and high scenario. The figures are based on 2 acres per well pad, 1.8 acres for access roads* and 1.8 acres for flow lines*. *NOTE: 2,640 ft (1/2 mile road length) x 30 ft. road or flow line width/43,560 sq. ft./acre = 1.8 acres.

Table 3-24: Possible Areas Disturbed From Drilling

Area Disturbed from Drilling			
Number of Wells	**Well Pads**	**Access Roads**	**Total**
Low 10	20 Acres	18 Acres	38 Acres
Med 15	30 Acres	27 Acres	57 Acres
High 20	40 Acres	40 Acres	80 Acres

It is assumed that all wells would be drilled within 10 years. Therefore, surface disturbance associated with exploration for full field development would be spread over 10 years at an average of 1 to 2 wells per year. The total acreage disturbed will be approximately 57.0 acres (3.8 acres per well/access, or about 5.7 acres per year).

The producing well sites (approximately 80 percent of the total wells drilled, 12 wells) will be reduced to a maximum area of 10,000 square feet after the well is put in production. Table 3-25 displays the estimated area disturbed from production, under a low, medium, and high scenario.

Table 3-25: Possible Area Disturbed From Drilling.

Area Disturbed From Production				
Number of Wells	**Well Pads**	**Access Roads**	**Flow Lines**	**Total**
Low 8	2.0 Acres	14.5 Acres	14.5	39 Acres
Med 12	3.0 Acres	21.6 Acres	21.6	58.2 Acres
High 16	4.0 Acres	28.8 Acres	28.8	77.6 Acres

The total acreage from drilling and production disturbed after all wells are drilled will be approximately 78.6 acres (57 Acres Drilling plus 21.6 Acres Flow Lines). It should be noted that the total amount of disturbances will not occur at the same time and wells will be abandoned and restored during the years of field development over the life of the Revised Forest Plan.

To adequately disclose what environmental impacts are associated with this projected activity, the drilling process needs to be itemized and analyzed.

Typical Drilling Scenario

Historically, wells in Arkansas are drilled on 640-acre spacing. The number of wells drilled is dependent on the oil and gas market values and the perceived impact of the lease stipulations by the oil and gas industry.

In this geographic area, the standard approach is to drill vertical holes from a single drill pad down to the target formation. The deeper the suspected oil/gas bearing rock layer lies, the larger the drill rig must be and, consequently, the larger the drill pad must be to accommodate it. Since the known producing zones lie relatively shallow with deeper plays to 6,000 feet, smaller drill rigs and pads are needed. Once the APD has been obtained from the BLM, the operator will construct an access road to the drill site and smooth out a pad to erect the derrick on.

As stated in the RFD scenario, preparation for the drilling process includes construction of a drilling pad and reserve pit. Construction procedures must conform to the approved surface use plan of operations. Typically, one to two acres are cleared and graded level for construction of the well pad. However, depending on the topography of the well site and access area, this construction may require the creation of cut slopes and fill areas that may disturb additional area. The excavated reserve pit is usually about five feet deep and is lined with bentonite clay. Plastic or

butyl liners (or its equivalent) that meet state standards for thickness and quality are used on occasions when soils are determined incapable of holding pit fluids. Constructed access roads normally have a running surface (width) of approximately 15 feet and a right-of-way of 30 feet; the length is dependent upon the well site location in relation to existing roads or highways. The average length of road construction will be about one-half of a mile or less (approximately 1.8 acres disturbance).

Because the cost of rig time in drilling a well is usually several thousand dollars a day, drilling is conducted 24 hours a day, 7 days per week when possible. Wells are usually drilled in 7 to 30 days depending on the depth of the hole; the number and degree of mechanical problems; if a well is a dry hole or a producer; etc. Wells will be drilled by rotary drilling rig using mud as the circulating medium. Mud pumps would be used to force mud down the drill pipe; thereby, forcing the rock cuttings out of the well bore. Water used in the drilling process would normally be from a well drilled on the site; however, water could be pumped to the site from a local pond, stream, or lake through pipe laid on the surface. Water could also be hauled to the site by the use of water tanker trucks. Shallower wells could be drilled with air instead of mud. Pad size and access would be the same.

Approximately 500 barrels of drilling mud will be kept on the location. Mud will also be needed for some down hole logging programs. Water production will be expected during the life of the field, separation, dehydration, and other production processing may be necessary. Construction of facilities off Federal lands may be needed to handle this processing. Some processing or temporary storage may be necessary on site usually in the form of tanks.

Material used in construction of the pads and access road (i.e. rock, shale, or gravel fill) shall be obtained from pre-approved sources. Shale and/or gravel used in construction of the drilling pad shall be stockpiled when restoring the area. For all surface-disturbing activities, the topsoil to be removed will be stockpiled for redistribution over the disturbed area prior to fertilizing and reseeding of the site. Surface soil material stockpiles should be located to avoid mixing with other subsurface materials during construction and reclamation. Stockpile locations should be located so wind and water erosion are minimized and reclamation potential is maximized. In areas where excavation will be extensive or extreme, or where bedrock will be encountered, existing topsoil shall be replaced. Restoration of the area will include reseeding of the area with natural grasses as determined by the authorized Forest officer. If drilling results in a producing well, the drilling pad must be reduced to a maximum area of 10,000 square feet (0.23 acres) and the remainder shall be restored to blend into the natural terrain. For a producing well the operator will either install tanks on site to hold the oil and any produced water or else a pipeline will be hooked up to the well head and the product transported off site. A producing gas well will have a pipeline connected to the wellhead or "Christmas tree," and the gas will then be pumped off through these gathering lines. Either way, the amount of space required for these facilities is considerably less than the original pad size and will be reclaimed around the unneeded edges.

Pipelines and/or flow lines will be constructed in conjunction with the construction of the access roads whenever possible to minimize additional disturbance. Pipeline right-of-way shall not exceed 30 feet in width. Exact right-of way widths may be set by ground conditions. Whenever possible, pipeline when buried must be at a depth of at least 48 inches. Any deviation from the 48-inch depth must be approved by the appropriate Forest Service officer prior to any surface disturbing activity taking place. When possible, a common point of collection shall be established to minimize the number of production sites. All pipeline designs, construction, operation, and maintenance shall comply with Federal Safety Standard for Gas Lines, Code of Federal Regulations, Part 192, Title 49, unless more stringent requirements are required by the State of Arkansas.

If the well is a dry hole, or cannot produce commercial quantities of oil/gas, it will be closed by plugging and capping the top of the pipe in the hole. All equipment will be removed from the site and the drill pad area will be re-sloped and seeded with a mixture of native plants.

The BLM estimates that only 80 percent of the total wells drilled on the Ozark NF will produce commercial amounts of gas. That is, of the 10 to 20 (15 average) wells projected to be drilled over the next 10 years, only 8 to 16 (12 average) wells would be producers. The rest will be reclaimed within a month of building the drill pad.

With an average of 3.8 acres of disturbance for each well (1.8 acre for the access road and 2 acres for the drill pad), about 3.8 to 7.6 acres total each year would be disturbed on the Ozark NF for natural gas development. About 90 percent of this surface disturbance will be reclaimed within a month in the case of a producing well, with the remaining 10 percent being reclaimed at the end of the production phase of the well. For non-producing wells, 100 percent will be reclaimed within a month.

Specific impacts to air quality include fugitive dust from vehicle traffic on the access road and during construction of the drill pad. There will be tailpipe emissions from the vehicles transporting the rig and pipe to the site as well as from diesel motors for running the on site engines. In the few cases that natural gas may be encountered, some gas will be flared to the atmosphere in the production tests.

Water quality may be locally degraded by sedimentation resulting from air borne dust settling out on streams and lakes and from erosion of the access road and drill pad. A small fraction of the stockpiled topsoil from the site could be washed into the local drainage by storm runoff in the 7 to 30-day window that drilling is taking place.

Soil impacts include displacement and compaction. There will be an average of three acres per drill site (one acre of new road and two acres for the drill pad) of soil disturbance. The surface of the road and drill pad will be compacted by the use of vehicles and machinery. Impacts to soil resources are reduced by requiring pads to be constructed to protect topsoil until fully reclaimed. Topsoil is then replaced on the reclaimed site. Pads are also insloped and designed to reduce water runoff. When reclaiming the access road and drill pad, it is standard procedure to use a ripper to relieve compaction prior to re-contouring, spreading the topsoil over the disturbed

area, and seeding with native species. When gravel has been brought in to surface parking and work areas, the gravel is removed as part of the reclamation process.

Vegetation occupying the areas to be disturbed for road and pad will be uprooted and destroyed. Any commercial timber will be sold ahead of road and pad building. Wildlife will be displaced from the immediate area of surface disturbance, and the noise, lights, and activity of men and machines could disturb wildlife in the surrounding environs. However, some species will be benefited by the creation of vegetative edge effects and early serial habitat creation. Aquatic animals could be impacted by airborne dust settling on the nearby streambeds and pond bottoms. Sediment washed down from the disturbed sites would also adversely impact aquatic life.

Species on the Threatened or Endangered List will not be adversely impacted by drilling activity. Habitat areas containing these plant and wildlife species are inventoried and special stipulation(s) will be included in the leases that are issued. Even if a new T&E species or the new location of an existing one is found subsequent to a lease being issued, the standard terms of an oil/gas lease require that a survey for T&E species be completed in any proposed drilling location and if any are found, accommodation for it up to and including completely moving the drill site be done before surface activity can be permitted.

It is possible that oil/gas drilling will cause some adverse impact on recreational activities such as bird watching or hunting. These will, however, be short in duration and localized in effect. There could also be an increase in habitat created for some game animals thus making the local population larger and the hunting experience more successful.

Based on the topography of the Ozark NF, most visual impacts will be fairly subtle and easily screened from most view sheds. There will be some added visual contrast by small open spaces in areas that were once completely forested.

As with T&E species, cultural resource surveys must be done of all proposed access roads and drill pad locations to ensure no heritage resources are disturbed or lost. Depending on the sensitivity of the cultural resource and its susceptibility to disturbance, the road/drill site location can be moved. In a few cases, the oil/gas operator may choose to pay for complete excavation and curation of the cultural site in order to keep the proposed drill location in its original place.

There will be a positive economic effect on the local economy in areas close to drill sites. The drilling operation will rely on local merchants for food, fuel, and supplies (see Cumulative Impacts), and often housing as well. Pad and road construction is often subcontracted to local companies or companies employing local expertise.

Salable (Common Variety) Minerals

Common varieties of mineral materials (CVMM) include aggregate, landscaping rock, riprap, flagstone, and other earthen construction materials. Mineral materials are not

federal leasable minerals. The Forest and local State and County agencies use mineral materials for road aggregate. The Public uses primarily stone for building and home purposes, but occasionally uses aggregate for personal purposes such as resurfacing driveways. Most of the mineral materials used by the Forest Service are extracted from designated pits on the ranger districts. Listings of all such aggregate pits are in Table 3-27. Stone was disposed of from dispersed sites on the Buffalo Ranger District (Newton County), Bayou Ranger District (Pope County), Pleasant Hill Ranger District (Johnson County), and Mt. Magazine Ranger District (Logan County). Pit-run gravel was disposed of from established pits on the Sylamore Ranger District in Stone County (5 pits, from 1 to 4 acres in size), Buffalo Ranger District in Newton County (2 pits, ½ and 3 acres in size), Pleasant Hill Ranger District in Johnson County (2 pits, 1 acre each), and Boston Mountain Ranger District in Franklin County (11 pits, all under 3/4 acres in size), and Magazine Ranger District in Logan County (5 pits, 1 to 3 acres in size). There are a total of 24 pits on 4 ranger districts impacting a total of 37 acres (average 1.53 acres per pit) on the Ozark NF.

Congress gave the Forest Service authority to sell mineral materials to the public for both commercial and non-commercial purposes, similar to Forest Service sales of wood for commercial and non-commercial purposes. The Forests issue mineral material authorizations to the public, state, and county road departments.

No new mineral material sites were proposed in the current planning period. However, if a new pit were to be developed, the environmental effects of establishing it would include scraping off and stockpiling the topsoil for later use in reclamation of the site. There will be some soil loss from wind and rain runoff. A localized decrease in air quality will result from dust released from the mining of the material as well as vehicle traffic to and from the pit. Vehicle emissions will also temporarily lower the local air quality. Wildlife and vegetation will be displaced from the pit site itself. Noise associated with operating equipment, vehicle, and people in and around the pit and access road could disturb some nearby fauna. Depending on the site-specific location, visual quality may be impaired. However, vegetative screening can usually mitigate this to a large degree. Prior to any surface disturbance of the site, the mandatory surveys for threatened and endangered species and cultural resources will have been done. If any of these resources are present and mitigating measures will not be adequate to protect them, then the site will not be developed.

Private Mineral Rights (Reserved and Outstanding Mineral Rights)

The authority for the administration of mineral reservations is 36 CFR 251.15 or previously issued Secretary of Agriculture's rules and regulations that govern the exercise of mineral rights reserved in conveyances to the United States. The appropriate rules and regulations in effect at the time of the mineral reservation were incorporated as part of the deed by which the United States acquired the surface. Forest Service direction for the administration of reserved and outstanding rights is found in Chapter 2830 of Forest Service Manual 2800.

The exercise of private-mineral rights produces both mineral exploration and mineral development in various areas of the OSFNFs. The purpose of this section is to

discuss how the Forest Service manages mineral exploration and development on reserved and outstanding rights (ROR) under federal surface. In recent years, the Ozark NF has been administering private plans of operations on federal surface for 17 gas well sites.

There are currently about 84,191 acres of 100 percent private mineral rights and 46,473 acres of split mineral estate under federal surface.

An important difference in the administration of ROR is that the development of private minerals is a right of the mineral owner. Reserved mineral rights are subject to State laws, Secretary's Rules, and Regulations that were made part of the severance deed when the land was purchased by the United States. The 1911, 1938, and 1939 versions of the Secretary's Rules and Regulations (SR&R) did not require the operator to obtain a permit from the Forest Service. Later versions (1937, 1947, 1950, and 1963) did require a permit. In reserved mineral cases under SR&R 1937, 1947, 1950, and 1963, the operator must submit an operating plan. If the operating plan is acceptable, the Forest Supervisor will issue a "Reserved Minerals Permit." If the operating plan is not acceptable, the Forest Service shall meet with the mineral owner or lessee to negotiate modifications needed to make the plan acceptable. For outstanding minerals, the mineral owner or lessee provides the Forest Service a proposed operating plan. Execution of outstanding mineral rights is subject to the terms of the Severance Deed and State Law. The Forest Service reviews the plan, negotiates the operating conditions for mitigation of surface disturbance with the operator, and has no recourse to disallow the project, except through acquisition of the mineral estate. The Forests will document their approval with a "Letter of Concurrence" (FSM 2832.1), for outstanding mineral rights and for reserved mineral rights under SR&R 1911, 1938, and 1939.

The following discusses two interrelated potential effects relating to outstanding and reserved mineral rights on the OSFNFs: 1) The potential effects of the revised Forest Plan Alternatives on the exercise of private mineral rights on NFS lands, and 2) the potential effects of private mineral rights operations on NFS lands.
The exercise of private mineral rights to explore and develop privately owned minerals on NFS lands is a private decision, not a federal decision. 84, 191 acres on the OSFNFs lands were acquired subject to these private mineral rights. All Forest Plan Alternatives are subject to these existing private rights (outstanding and reserved mineral rights). The U.S. is bound by the terms of the mineral reservation. The development and operation of the reserved mineral rights is subject to the terms of the deed to the U.S., mineral reservation conditions (the Secretary's Rules and Regulations attached to the deed to the U.S.), and state law. For outstanding mineral rights the U.S. is bound by the terms of the prior legal transaction, which separated the mineral and surface ownerships and the development and operation of outstanding mineral rights is subject to state rules and regulations and case law.

A Comptroller General Report to Congress (GAO/RCED-84-101; July 26, 1984) found that the Forest Service in the eastern U.S. failed to provide Congress with information about private mineral rights and their potential effect on wilderness management. The GAO recommendation to the Secretary of Agriculture was "Because the Forest

Service did not analyze the potential problems or costs associated with private mineral rights when it developed its 1979 wilderness recommendations, GAO recommends that the Secretary direct the Forest Service's southern and eastern regional offices to do this type of analysis when reevaluating its wilderness recommendations. This analysis should include for each area consideration of private mineral development potential, the government's ability to control mineral development if it occurs, the need to acquire private mineral rights, and a range of acquisition costs."

These problems (management conflicts, litigation, and high costs) apply not only to Wilderness, but also to 1) any highly restrictive designation that conflict with exercise of private mineral rights on National Forest System lands, and 2) management prescriptions that impose severe restrictions on use of the surface or prohibit certain activities such as road construction or mining. Examples include special biological areas, wild & scenic river designations, wilderness study areas, or backcountry recreation areas.

The 5th Amendment to the U.S. Constitution provides that private property shall not be taken for public use without just compensation. In addition to designation or prescriptions that prohibit mineral development or are de facto prohibitions on mineral development, a "taking" can have other forms. For example, the time required to process private mineral activities under the Forest Plan's framework might result in unreasonable delays that amount to a "taking" of the mineral rights. Partial takings are also possible. Executive Order (EO) 12630 "Government Actions and Interference with Constitutionally Protected Property Rights" was signed in 1988. EO 12630 requires federal decision-makers to 1) evaluate carefully the effect of their administrative actions on private property rights, and 2) to show due regard to these 5th Amendment rights and to reduce the risk of undue or inadvertent burdens on the federal treasury. Concern about government "takings" of private property rights is a national issue.

Steps for processing private mineral rights are:

- Receipt of Proposal,
- Forest Service identification of course of action,
- Negotiation for acceptable terms,
- Document via a Letter of Concurrence for outstanding and reserved mineral rights under Secretary's Rules and Regulations 1911, 1938, and 1939, and for reserved mineral rights under Secretary's Rules and Regulations 1937, 1947, 1950, and 1963, and
- Issuance of a Reserved Minerals Permit.

Forest Service direction on Reserved and Outstanding Mineral Rights can be found in Forest Service Manual (FSM) 2800, Chapter 2830. For distribution of private mineral estate, a Special Use Permit/Road Use permit would be required.

The categories of federal oil and gas leasing availability/consent such as Controlled Surface Use and No Surface Occupancy, for different management prescriptions

apply to federal oil and gas leasing, and not directly to the private mineral rights. However, the categories show the level of restrictions placed on federal oil and gas activities, and thus, indirectly indicate potential for conflict with exercise of private mineral rights in those same management areas. The Plan alternatives do not significantly conflict with private mineral rights.

Determination of Effects

The determination of effects on the mineral resources of the OSFNFs is measured by availability of the lands for mineral leasing and development and the restrictions placed on development within each management area by alternative. There are 1,161,015 acres of federal minerals under forest administration, of which the Wilderness Act and the Wild & Scenic Rivers Act (designated Wild River section is withdrawn) statutorily withdrew 68,728 acres (6%), leaving 1,094,287 acres (94%) of minerals available for leasing.

Of the 1,094,287 acres of lands available for lease, there are three levels of restrictions on mineral development:

- Lands leased subject to standard lease terms;
- Lands leased subject to a Controlled Surface Use (CSU) stipulation; and
- Lands leased subject to a No Surface Occupancy (NSO) stipulation.

Table 3-26 lists the acres and percentage of lands available subject to each level of restriction, under each plan alternative.

Table 3-26: Oil & Gas Leasing Consent Decisions (Acres and Percents) by Alternative.

Leasing Consent Decisions	Alternatives				
	A	B	C	D	E
Withdrawn	(68,286) 5.8%	(68,286) 5.8%)	(68,728) 6%	(68,286) 5.8%	(68,728) 6%
NSO: No Surface Occupancy Stipulation	(38,085) 3.3%	(38,085) 3.3%	(39,017) 3.4%	(38,085) 3.3%	(39,017) 3.4%
CSU: Controlled Surface Use Stipulation	(93,027) 8%	(163,257) 14.1%	(435,179) 37.5%	(137,872) 11.9%	(458,883) 39.5%
NSO or CSU (Custodial Management)	(13,380) 1.2%	(538,390) 46.4%	(19,599) 1.7%	(13,380) 1.2%	(19,599) 1.7%
Standard Stipulations	(945,453) 81.5%	(354,632) 30.6%	(598,422) 51.6%	(905,025) 78%	(574,759) 49.5%

When considering the OSFNFs' total acreage, the following applies for each alternative evaluated in the FEIS/Plan: 130,664 acres (11% of the Forests) are 100 percent private mineral rights and 68,286 acres (approximately 6% of the Forests) are acres designated as Wilderness and/or Wild River segments, which are withdrawn from any type of mineral development. The mineral potential for the

Forests cannot be fully evaluated on the lands that are not available for mineral entry. Consequently, the mineral resource will not be explored or developed on withdrawn status lands.

The direct effect of each alternative would be to decrease the lands available for lease under Standard Stipulations (standard lease terms) from 81.5 percent under Alternative A (Current) to 30.6 percent under Alternative B; 51.6 percent under Alternative C; 78 percent under Alternative D; and 49.5 percent under Alternative E. By adopting the preferred alternative (Alternative E), the lands available for lease under Standard Stipulations would decrease by 40 percent over Alternative A (81.3%). The total acreage available for lease would remain virtually the same.

The acreage added to the restricted category will indirectly make mineral operations on the Forests more difficult and potentially more expensive for the lessee but it would allow for increased resource protection on the Forests. In addition, these restrictions could force companies off NF lands onto lands with reserved or outstanding mineral reservations where the Forests would have less control over surface disturbing activities.
All alternatives provide for energy development to meet future demand. Some alternatives have more restrictive stipulations because of other multiple-use constraints (see Table 3-28). Alternatives A, C, and D provide less restrictive opportunities to explore for, develop mineral resources on the OSFNFs because they allow for maximum commodity production with minimal emphasis on withdrawals, and have less restrictive operating conditions. Alternatives B and E provide for energy production with slightly more restrictive stipulations.

Cumulative Effects

The only cumulative effects anticipated to result from mineral activity on the OSFNFs over the next 10 years would be associated with natural gas development. It is projected that over the 10-year plan period, there will be 15 gas wells drilled on the Ozark NF, with 12 being commercially productive. The rest would be dry holes and the sites would be reclaimed. For each of the producing well sites, the area needed for production would be less than was needed for the drilling phase. The size of the drill pad would decrease from two acres of disturbance down to about one-quarter acre, with the unneeded portion being reclaimed. Thus, there would be a residual of 2 acres per new producing well (1.8 acres for the access road and ¼ acre containing the pump jack and ancillary tanks or pipelines) not reclaimed until production ceased. The BLM's reasonable foreseeable development scenario puts the expected number of producing wells at 8 to 16. At 2 acres per new producing well, that would mean that there would be 16 to 32 acres of new, un-reclaimed area over the 10-year plan period. The average surface disturbance over the term of the Forest Plan would approximately be 1.6 to 3.2 acres per year.

Pipelines are typically constructed in road rights-of-way. Cumulative effects from pipelines are limited when construction occurs in established rights-of way. The time it takes to dig the linear pipeline trench, place the pipeline, backfill the trench and pipeline, and reclaim the trench is only a matter of hours for a given linear section.

Special trenching machinery allows for a light touch and shorter widths on the land surface when trenching is required across country. Minimum pipeline width is approximately 36 inches. In some cases, pipelines can be pushed for short distances through the subsurface without requiring surface excavation. Pipeline surface impacts are immediately reclaimed, thereby, effectively making the pipeline trench a truly short duration surface impact. After gas production ceases, pipelines are flushed and may be left in place or removed. The determination to leave or remove a pipeline is made in the Environmental Analysis.

When looking at potential cumulative impacts to air quality, water quality (hydrology), aquatic habitat, wildlife, T&E species, soils, and visuals over the life of this Plan, the impacts would be negligible.

There are positive economic impacts resulting from oil and gas exploration and development activities. Lessees/operators usually contract locally for road and drill pad construction. They purchase food, fuel, lodging, and other supplies from local sources and may subcontract certain parts of the operation to local well servicing companies. Most of the salaries paid to workers are spent in the local area. The estimated dollars that an average drill rig generates per day is over $200 per worker. A typical well drilling operation will have an average of 10 to 20 workers. This translates into about $2,000 to $4,000/day spent in the local area. Since the average gas well in this area takes 2 to 4 weeks to complete, $28,000 to $112,000 per well goes into the economy.

BIOLOGICAL ELEMENTS

Historical Perspective

The forest, plant, and animal communities of the Ozark NF are rich and diverse. They are dominated by oak-hickory-pine in what is now called the Central Hardwood Region estimated to have formed at least 5,000 years ago (Spetich 2004:3). The St. Francis NF falls in the Mississippi Delta and includes Crowley's Ridge, a distinctive ecosystem that is often called a "Southern Appalachian refugium" with tulip trees, magnolias, and other hardwoods mixed with open prairies that are relicts from past plant migrations.

Humans have been a constant influence on plant communities and ecosystems of the Highlands, Delta, and Crowley's Ridge for thousands of years (USDA Forest Service 1999:xi). The species composition of these forests and prairies have been extensively changed by two major occurrences:

- Over 10,000 years of Native American agroforestry that maximized the yields of mast crops, domesticated oily seed native plants, and introduced tropical cultigens; and
- Over 150 years of intensive historical settlement, agriculture, and fragmentation including deforestation by logging companies.

Despite this, a high level of diverse habitats including mosaics of prairie, savanna, open and closed woodlands, and riparian forests remain. The high diversity found on the OSFNFs today is testimony to the resilience of ecosystems. The following sections describe the effects of FEIS alternatives on plant and animal communities. This introductory section provides some historical context to be used as a reference point when comparing expected future habitat outcomes, and describes effects to viability of associated species.

Much of the OSFNFs were completely logged by the early 20th century. The only systematic landscape scale data available for the character and composition of pre-settlement historical vegetation (reference conditions) are derived from the General Land Office (GLO) surveys. Dominant canopy tree species were used as legal "witness" trees. The percent ages by species are an indication of the dominant species found on the landscape during the mid-1800s. Further study is in progress to determine spatial pattering, canopy closure, and basal area. The tree species fall into four ranked categories: I (Dominant, >19%), II (Subdominant, between 5 and 18%), III (Less Common, between 4 and 0%), and IV (Rare, < 0%). Table 3-27 lists the species (identified by common name) found in each category.

Table 3-27: Tree Species Identified in GLO Records.

Category Number	Category Name	Species (Common Name)
I	Dominant > 19%	White Oak (35.4%), Black Oak (19.1%)
II	Subdominant 18-5%	Hickory (6.7%), Post Oak (6.6%), Pine (5.4%), Black Gum (5.3%), Red Oak (5.1%)
III	Less Common 4-0%	Beech, Spanish Oak, Dogwood, Elm, Sweet Gum, Chinquapin, Maple,
IV	Rare < 0%	Ash, Birch, Black Ash, Black Haw, Black Locust, Black Walnut, Blackjack Oak, Blue Ash, Box Elder, Buckeye, Cedar, Cherry, China, Chinquapin Oak, Cottonwood, Cucumber, Cypress, Gum, Gum Elastic, Hackberry, Honey Locust, Hornbeam, Ironwood, Linn, Locust, Magnolia, Mulberry, Oak, Overcup Oak, Pawpaw, Persimmon, Pin Oak, Plum, Poplar, Prickly Ash, Privet, Red Bud, Red Elm, Red Haw, Sassafras, Service, Slippery Elm, Sugar Maple, Sycamore, Walnut, Water Oak, White Ash, White Hickory, White Walnut (Butternut), Willow, Willow Oak

Note: Red Cedar (a fire susceptible species) was rare on the historical landscape, but is dominant on modern landscapes due to fire suppression and fragmentation of the hardwood-pine canopy.

These surveyors noted several aspects of local ecology, including "this mile all undergrowth dead and dying" representing wildfires; "thick dead, and green brush," "oak and chinquapin rough with few trees," "open, thin oak woods, with oak bushes"; "rocky barrens" with "oak, hickory, and chinquapin bushes and sage grass." They noted fire dependent cane in floodplains and bottoms as well as fire-caused "barrens" in upland settings. Chinquapin and oak bushes were frequently described as "stobs"; suggesting root-collar sprouts caused by frequent fire and resprouting

from stumps. Most notable disturbances recorded in the GLO records are tornados, passenger pigeon roosts, wildfires, and canebrakes in floodplains that require an 8-year burn cycle to regenerate

DESCRIPTION OF ECOLOGICAL UNITS

Affected Environment

The National Hierarchical Framework of Ecological Units is a classification and mapping system for dividing the Earth into progressively smaller areas of increasingly similar ecology. Ecological units are mapped based on patterns of climate, soils, air quality, hydrology, geology, landform and topography, potential natural communities, and natural disturbances.

These various components take on greater or lesser importance as the mapping scale changes. Conditions dominant at broad scales such as climate and geology are continually related to conditions more important at finer scales such as biologic communities and soil characteristics. Table 3-28 illustrates the national hierarchy of ecological unites used by the Forest Service.

Table 3-28: Forest Service National Hierarchy of Ecological Units.

Planning and Analysis Scale	Ecological Units	Purpose, Objectives, and General Use	General Size Range
Ecoregions			
Global	Domain	Broad application for modeling, sampling, strategic planning, and assessment.	Millions to tens of thousands of square miles.
Continental	Division		
Regional	Province		
Subregions	Section	Strategic, multi-forest, statewide, and multi-agency analyses and assessments.	Thousands to tens of thousands of square miles.
	Subsection		
Landscape	Landtype Association	Forest-wide planning and watershed analyses.	Thousands to hundreds of acres.
Land Unit	Landtype	Project and management area planning and analyses.	Hundreds to less than 10 acres.
	Landtype Phase		
	Sites		

Source: ECOMAP, 1993

The OSFNFs have completed an approximation of landtype associations (LTAs). Currently, twenty-one LTAs are identified on the Ozark NF and three LTAs are identified on the St. Francis NF. The LTAs have been delineated on lands within the proclamation boundaries of the national forests. These ecological units fit, or nest, within the higher levels of the National Hierarchical Framework of Ecological Units. The primary use of these units will be for watershed analysis and forest-wide planning. Maps, descriptions, and supporting data for the LTAs are on file in the Forest Supervisor's Office in Russellville, Arkansas. Landtypes have been delineated, but they have not been finalized.

The Ozark National Forest (NF) generally lies within the Hot Continental Division of the Humid Temperate domain. Within this division, the main part of the forest and the Lee Creek Unit are in the Boston Mountains Section of the Eastern Broadleaf Forest (Continental) Province. The Wedington Unit, the Koen Experimental Forest, and the Sylamore Ranger District Ranger District are in the Ozark Highlands Section of the Eastern Broadleaf Forest (Continental) Province.

The Subsections in the Boston Mountains Section include the Upper Boston Mountains and the Lower Boston Hills. The Upper Boston Mountains Subsection includes the northern part of the Boston Mountain, Pleasant Hill, Buffalo, and Bayou Ranger Districts (above 1,800 feet in elevation). The Upper Boston Mountains consist of low mountains (1,800 to 2,700 feet in elevation) underlain by Pennsylvanian sandstone and shale with sandy residuum and loamy colluvium. This subsection is covered with oak woodlands and forests. Three LTAs and portions of two others have been delineated in this subsection. The Lower Boston Mountains Subsection includes the southern parts of the Boston Mountain, Pleasant Hill, Buffalo, and Bayou Ranger Districts, and the Lee Creek Unit (above 800 feet elevation). The Lower Boston Mountains consist of high hills (800 to 1,800 feet in elevation) underlain by Pennsylvanian sandstone and shale with sandy residuum and loamy colluvium. The Lower Boston Mountains are covered with pine-oak and oak woodlands and forests. Seven LTAs have been delineated in this subsection.

The Subsections in the Ozark Highlands Section include the Springfield Plateau, Central Plateau, and White River Hills. The Springfield Plateau Subsection consists of the Wedington Unit, the Koen Experimental Forest, and the south central part of the Sylamore Ranger District. The Springfield Plateau Subsection is made of smooth to irregular plains (800 to 1,400 feet in elevation) with karst features. Underlain by Mississippian limestone (sometimes very cherty) and cherty clay residuum, this subsection is covered with prairies; oak woodlands and forest; and alkaline and acid glades. Five LTAs and portions of two others have been delineated in this subsection. The Central Plateau Subsection includes the northeastern part of the Sylamore Ranger District. The Central Plateau Subsection consists of irregular plains (300 to 1,600 feet in elevation) with karst features on Ordovician cherty dolomite, sandstone, and cherty clay residuum covered with prairies, oak woodlands, and dry mesic oak forests. One LTA has been delineated in this subsection. The White River Hills Subsection includes the northwestern portion of the Sylamore Ranger District. This subsection consists of hills with entrenched valleys and karst features. It was formed by streams down-cutting to the White River. Underlain by Ordovician cherty

dolomite with cherty clay residuum and ranging from 600 to 1,600 feet in elevation, this subsection is covered with alkaline glades and oak woodlands and forests. One LTA has been delineated in this subsection.

The extreme southern part of the Bayou Ranger District (below 800 feet elevation), the Magazine Ranger District, and the St. Francis NF lie within the Subtropical Division of the Humid Temperate Domain. The southern part of the Bayou Ranger District and the Magazine Ranger District are in the Arkansas Valley Section of the Southeastern Mixed Forest Province. The St. Francis NF is in the Mississippi Alluvial Basin Section of the Lower Mississippi Riverine Forest Province.

The Subsections in the Arkansas Valley Section include the Eastern Arkansas Valley and Western Arkansas Valley Mountains. The Eastern Arkansas Valley Subsection consists of the extreme southern part of the Bayou and Pleasant Hill Ranger Districts that are below 800 feet elevation. The Eastern Arkansas Valley consists of plains with hills 300 to 800 feet in elevation. Underlain by Pennsylvanian sandstone and shale with sandy residuum, this subsection is covered with pine-oak and pine woodlands and forests. One LTA has been delineated in this subsection. The Western Arkansas Valley Mountains Subsection includes the Magazine Ranger District. The Western Arkansas Valley Mountains consist of low mountains and ridges and some wide valleys. Ranging from 750 to 2,800 feet in elevation, the Western Arkansas Valley Mountains are underlain by Pennsylvanian sandstone and shale with shaly residuum and covered with pine-oak woodlands and forests and prairies. Four LTAs have been delineated in this subsection.

The Subsections in the Mississippi Alluvial Basin Section include Crowley's Ridge and the St. Francis River Alluvial Plain. The Crowley's Ridge Subsection includes the uplands on the St. Francis NF. Crowley's Ridge is an isolated low ridge ranging from 300 to 500 feet in elevation. It is made of Pleistocene loess underlain by Cretaceous and Tertiary non-marine sediments. The ridge is covered with mesic hardwood forests. Two LTAs have been delineated in this subsection. The St. Francis Alluvial Plain Subsection includes the bottomlands on the St. Francis NF. The St. Francis Alluvial Plain consists of flat plains ranging from 0 to 300 feet in elevation. It is made up of Holocene alluvial clay, silt, sand, and gravel. This subsection is covered with bottomland hardwood forests. One LTA has been delineated in this subsection.

Direct, Indirect, and Cumulative Effects

There are no environmental consequences (direct, indirect, or cumulative effects) related to this section.

MAJOR FOREST COMMUNITIES

Major forest communities are defined as those ecological communities that are dominated by trees and together cover the majority of the national forest landscape. They include abundant community types, as well as those uncommon types that are not considered rare or special communities. These communities have been identified and defined primarily using the International Ecological Classification Standard

(NatureServe 2003, 2004, 2005) developed by NatureServe, an international non-profit organization whose mission is to develop, manage, and distribute authoritative information critical to the conservation of the world's biological diversity. In some cases, community names and definitions have been modified from the Draft EIS to better correspond with this classification standard. Community names have been simplified from this standard for clarity in presentation and ease of use (See Table 3-29). In a few cases, ecological systems have been lumped or split to better meet planning needs.

Table 3-29: Major Forest Communities on the OSFNFs.

Major Communities on the Ozark NF		
Community Name	**Acres**	**Percent**
Dry Oak Forest and Woodland	351,000	32%
Shortleaf Pine-Oak Forest and Woodland	291,000	26%
Dry-Mesic Oak Forest	436,000	40%
Mesic Hardwood Forest	7,000	<1%
Riparian Forest	2,900	<1%
Loblolly Pine Forest	13,229	1%
Community Name	**Acres**	**Percent**
Loess Slope Forest	16,200	86%
Bottomland and Floodplain Forest	2,500	13%
Loblolly Pine Forest	137	1%

Note: Acres are approximate

Analysis Methods

The following sections address effects of plan alternatives on these communities. Following sections that apply to multiple community types, each community is addressed separately. First, the community is defined and existing conditions described. Then, *key factors* are identified and defined. These factors are those deemed critical for forest managers to address in order to sustain healthy forests and associated wildlife habitats and populations. For each key factor, one or more quantifiable *indicators* are identified to measure current and future status of the key factor. These indicators are the primary means for analyzing and comparing effects of plan alternatives. They are also designed to serve as elements to be monitored during plan implementation. *Benchmarks* for each indicator are set to represent "poor," "fair," "good," "very good," and "optimal" outcomes relative to sustaining these communities. Generally, "good," "very good," and "optimal" outcomes are deemed sufficient to sustain all the parts and processes within the community; "fair" and "poor" outcomes may result in loss of important parts and processes, including populations of some species. This framework for conservation planning generally follows a conservation planning tool developed and used by The Nature Conservancy, a leading international, nonprofit organization dedicated to preserving the diversity of life on Earth.

Setting ecological benchmarks is necessary to answer the question "*How much is enough*?" relative to each ecological condition represented by an indicator. This question is one of the most critical and difficult ones to be answered during

conservation planning. Setting ecological benchmarks may be done using a variety of methods, including use of historical reference conditions, and identification of individual species' needs (Groves 2003). For this analysis, benchmarks were identified with the help of ecology experts (both internal and external to the Forest Service), who were convened and consulted throughout the planning process. Because most indicators represent measures of conditions across large landscapes—a scale at which quantitative ecological research is limited—precision in setting benchmarks for these indicators is typically low. Benchmarks, therefore, usually represent expert opinion based on:

- Understanding of the range of variation of indicator values present during a historical reference period, or
- The indicator levels needed to sustain viability of all existing species associated with the community, with implicit consideration of those species with the most demanding requirements.

Some benchmarks were also influenced by descriptions of historical reference conditions being compiled as part of the Fire Regime and Condition Class Interagency Handbook (http://www.frcc.gov/). These reference conditions include estimates of fire return intervals and percentages of successional stages for many ecological communities.

The historical reference period for this analysis is defined as the period of approximately 1400 to the early 1800s, which represents conditions just prior to major ecological changes brought by European contact and settlement of the region. The assumption is that these reference conditions represent those to which native ecosystems and species are best adapted, and, therefore, would best provide for system sustainability and species viability. Because solid documentation on these reference conditions is relatively sparse, expert judgment is needed, and precision in defining these conditions is not high.

Unless compelling evidence or rationale was available, benchmarks for "poor," "fair," "good," and "very good" were defined consistently based on a percentage of the "optimal" benchmark level (Table 3-30). Higher percentages of the optimal benchmark were used when the indicator condition would be rare even under optimal conditions; lower percentages were used for indicators that would be common under optimal conditions. This approach is based on the assumption that, in general, more common conditions are less likely to be critically limiting to ecosystem sustainability and viability of associated species than would rarer conditions.

Table 3-30: Percent of the Optimal Benchmark Used to Calculate Benchmarks Representing Poor, Fair, Good, and Very Good Values of Indicators When Other Compelling Rationales Are Not Available.

Percent of Optimal Benchmark				
Percent of NF Acreage Occupied by Indicator at the Optimal Benchmark	Poor	Fair	Good	Very Good
> 10%	< 30%	30%-55%	55%-75%	> 75%
1% to 10%	> 50%	50%-70%	70%-85%	> 85%
< 1%	> 70%	70%-85%	85%-95%	> 95%

Note: Percentages vary by relative abundance (percent of national forest acreage) of the indicator at an optimal state. Benchmarks are higher for indicators representing rarer conditions, and lower for indicators representing more common conditions.

Because they are often based on expert opinion, sparse research, and standard percentages, benchmarks should be viewed as coarse estimates, not hard thresholds. In addition, benchmarks are not intended to represent overall desired conditions for the OSFNFs because they do not incorporate all of the multiple-use and logistical issues that must be considered as part of the planning process. Where consistent with multiple-use desired conditions, they may be incorporated into desired condition descriptions for the plan. However, benchmarks should be viewed primarily as planning tools that are useful for assessing ecological outcomes expected under planning alternatives, and for evaluating management performance during monitoring of plan implementation.

Values for indicators were calculated or identified for current conditions and for 10 and 50 years under each alternative. Indicators involving forest age class or structure were calculated based on results from SPECTRUM modeling. Management activity levels from SPECTRUM were averaged over the first five decades and applied to current conditions to derive resulting forest age and structural mixes. Indicators involving fire were calculated for current condition using GIS analysis of prescribed fire records. Future values of these indicators were estimated by taking the total average annual prescribed burn acreage set for each alternative (Table 2-23 on Page 2-34) as a percent of total ecosystem need. Total ecosystem need was calculated as the sum of acreage for each ecological system that would need to be burned annually to keep these systems on desired average fire return intervals. Indicators involving desired level of advanced oak regeneration were qualitatively assessed based on empirical data on current condition and projected levels of indicators for older forest density and fire regimes.

Common Key Factors and Indicators

Age diversity is a key factor common to most major forest communities. This factor is important because trees and forest stands do not remain static, but grow older and change over time. Maintaining a healthy forest community over a large landscape through time requires maintaining relatively stable mixes of tree and stand ages through regular forest regeneration. This regeneration may be regulated by natural events, management action, or a combination of both. A relatively balanced

distribution of tree ages is desirable for most forest communities to help them withstand the variety of potential forest health threats that might target specific ages and conditions. Balanced age distributions also provide sustained availability of diverse habitat conditions over time. Age diversity may be achieved through even-aged or two-aged stands of different ages spread across a landscape, or as diverse ages of trees within uneven-aged stands. Current age distribution for most forest community types on the OSFNFs is not highly diverse due to extensive cutting of forests in the early 1900s. This widespread ecological disturbance has resulted in a large percentage of the Forests being nearly the same age (80 to 100 years old). Efforts to regenerate OSFNFs over the last few decades have diversified age classes to some extent. At the same time, forest aging is adding older age classes to the mix. However, age distributions remain imbalanced and are, therefore, an appropriate focus for decisions involving vegetation management.

Common indicators for age diversity are used in this analysis for most forest communities. These are the percent of community acreage that is classified as mature (older than 70 years), possible old growth (older than 100 to 130 years depending on forest community type), regenerating (0 to 10 years old), and regenerating and young combined (0 to 40 years old). The first two indicators focus on the need for older forests, while the second two target younger forest conditions. If all these indicators are at desirable benchmark levels, then the community is at or moving toward relatively balanced mixes of all age classes. Large surpluses in some indicators and shortfalls in others indicate an unsustainable imbalance.

Age-class diversity is traditionally calculated with the assumption that forests are all even-aged or two-aged. For the purposes of this analysis, uneven-aged stands are incorporated into these indicators by counting a proportion of their acreage to each age class. This approach recognizes the value of uneven-aged stands in diversifying tree ages to improve forest health. The actual proportion from stand to stand may vary widely, so for calculation purposes an average proportion is used, based on a balanced within-stand distribution of area occupied by each 10-year age class up to 120 years. This maximum age is a ballpark estimate of the likely average maximum age of trees within such stands over the 50-year planning horizon. While this approach is admittedly coarse, there are relatively few acres that meet true uneven-aged conditions on the OSFNFs; therefore, uneven-aged acres are expected to only marginally affect these indicators.

Plan alternatives affect age class diversity primarily through levels of regeneration cutting (shelterwood and seedtree cutting, clearcutting, single-tree and group selection cutting). Differences in indicators among alternatives reflect differences in amounts of regeneration cutting.

A second key factor common to several forest communities is fire regime. Fire regime is defined by the frequency and seasonality of repeated fires, caused by planned or unplanned ignition. In some communities, vegetation structure and composition are dependent upon or enhanced by periodic fire. Evidence indicates that fire was much more prevalent during the historical reference period than in it has been over the past century. Some of this fire occurred during the growing season, when effects on

vegetation can be more pronounced. Lack of fire in many cases has resulted in denser forests and declines in species associated with open habitats. Plan alternatives affect the fire regime primarily through differing levels of prescribed burning. Indicators for this factor are defined as the proportion of community acreage that has been burned within the upper end of desired fire return intervals, in both any season and within the growing season. Throughout this analysis, indicators for a given alternative are at the same level across forest community types and time frames. Results are the same across time frames because a stable program over time is assumed. Results are the same across forest community types because fire is assumed to occur proportionally across types as weighted by desired fire return intervals. For example, it is assumed that the fire program will be applied, on average, so that the same proportion of Shortleaf Pine-Oak Forest and Woodland is burned on a desired 3-year interval as will Dry-Mesic Oak on a desired 5-year interval. This assumption anticipates that areas with high proportions of communities with more frequent desired return intervals will be burned more often than areas dominated with less frequent desired return intervals.

A third key factor common to several forest communities is density of trees in mid-aged and mature forests. Currently, many stands across forest community types support high-density closed-canopy forests (> 80 percent canopy closure). These conditions are the result of removal of fire from many sites, and the relatively uniform age of forest stands that has resulted from forest cutting early in the 1900s. High tree densities in mid-aged and mature forests are undesirable because they stress trees making them more susceptible to insect, disease, and drought. In some forest communities, high densities, especially in the midstory, also suppress desired development of understory, including advanced oak regeneration and food and cover for wildlife. In other communities, dense uniform canopies do not provide the diversity of canopy structure preferred by some wildlife species and which were likely typical of old growth conditions For these reasons, open canopies (60 to 80% canopy closure), or canopies with gaps are often preferred. The indicator used for this key factor is the percent of mid-aged (41 to 70 years old) and mature forests (older than 70 years) with open canopies or canopy gaps. Plan alternatives affect forest density primarily through levels of forest thinning and uneven-aged regeneration cutting.

Cumulative Effects

Cumulatively within the national forests over the analysis horizon of 50 years, natural disturbance events will contribute to changes in age diversity and forest structure. These events may include wind and ice storms, insect and disease infestations, and wildfires. Effects from these events have been implicitly incorporated into the setting of benchmarks. However, they have not been included in quantitative estimates of indicators in order to keep focus on differences in management intent among alternatives.

These natural or unplanned disturbance events will tend to increase estimates for disturbance-dependent indicators, such as percent of regenerating and young forests and percent of older forests with open canopies or canopy gaps, and decrease low disturbance indicators such as percent mature forest. Some disturbance factors,

such as wind and ice storms, are likely to operate independent of management, resulting in similar effects across alternatives. Other factors, such as insects, disease, and wildfire, may be affected by management intensity, with greater effects likely under alternatives that are not as proactive in addressing forest health threats and fuel loads. These factors would tend to moderate differences in outcomes—higher levels of unplanned disturbances would likely compensate for lower levels of planned disturbances and vice versa. However, it is important to note that many unplanned disturbances are not likely to create desired conditions to the extent that they might have under historical or reference conditions. For example, because of fire suppression over the past century, the recent red oak mortality on the Ozark National Forest will result in a very different condition than it would have if forests had been maintained in relatively open condition. Today, this event threatens to greatly reduce oak dominance in many stands; whereas, under historical conditions, oaks would likely have been in a better position to replace themselves. Nevertheless, where desired conditions are created by unplanned events, they will be monitored as contributing to achievement of forest plan outcomes, and planned management actions will be adjusted accordingly.

Intermixed, adjacent, and nearby private lands contribute to cumulative effects related to major forest communities on the larger landscape surrounding the national forest. Timber management on private lands can contribute to younger age class distributions on the landscape as a whole. However, human population, income, and housing units have grown over the past decade on private lands surrounding the Ozark National Forest (see analysis under Social and Economic Environment) and are expected to continue to grow as this area continues to attract retirees and second homes. These trends typically result in loss of forests to development, decreases in active forest management, disruption of natural disturbance regimes, increases in abundance of older forests, and more opportunities for invasions of non-native species, insects, and diseases (Stein et al. 2005). These trends will make maintaining appropriate disturbance regimes and desired structures on national forests more difficult and at the same time more critical to the goal of sustaining native ecosystems and species.

In the area of the St. Francis National Forest, populations and housing units have actually declined in the last decade, and income is low relative to the rest of the state. Private lands in the area are primarily cropland. Significant changes in forestland condition are not expected due to their small proportion of the landscape and the lack of significant economic activity in the area.

Regardless of the condition of surrounding private lands, it remains the responsibility of the Forest Service to manage national forest lands for sustained uses and ecological conditions. This mandate implies that national forest lands be managed of themselves to provide a diverse and sustainable mix of forest successional stages and structural conditions.

Oak Decline and Oak Regeneration

Challenges related to oak decline and regeneration applies to ecological systems that are dominated by oak. These include Dry Oak Forest and Woodland, Dry-Mesic Oak Forest, and Loess Slope Forest.

In the spring of 1999, Forest Service staff discovered an area of severe oak mortality in Johnson County, north of Clarksville, Arkansas. Local field and aerial observations quickly determined that an unprecedented natural event involving damage and mortality of a large number of oaks was occurring on the Ozark National Forest. By June 2002, over 300,000 acres had experienced severe oak mortality and damage and additional acreage experienced moderate to light mortality and damage. Several causes were involved, primary of which were an epidemic of red oak borer and severe regional drought. Red oaks were primarily affected. Because oak-dominated forests cover more than 70 percent of the Ozark National Forest, this event caused great concern and widespread changes to forest age, composition, and structure (Spetich 2002).

Loss of red oak trees affected age class distribution of oak forests by shifting approximately 44,000 acres of mid-aged and mature forests towards younger age classes. This change in age class distribution appears small relative to the total number of acres affected because, in many stands, not all oaks died and other tree species remained, resulting in retention of stand age. In other cases, especially in mid-aged stands with higher percentages of red oak, oak mortality resulted in re-aging the stand to a younger age class.

Even with some stands moving to younger age classes, current age-class distribution of oak-dominated forests remains heavily weighted toward older forests, with close to 50 percent over 100 years of age (Table 3-31). Most of these older forests also support relatively high tree densities (greater than 100 square feet of basal area per acre). Stands in this condition are at continued risk for oak decline events should environmental stressors reoccur (Starkey, Stedman, Oak, and Yockey 2004).

Table 3-31: Approximate Acreage and Percent of Successional Stages Within Oak-Dominated Forest Types on the OSFNFs (CISC Data Modified in 2003 to Reflect Recent Oak Mortality).

Successional Stages	Acres	Percent
Regenerating Forest (0-10 years old)	27,900	4%
Young Forest (11-40 years old)	39,400	5%
Mid-aged Forest (41-70 years old)	11,400	1%
Mature Forest (71-100 years old)	336,000	43%
Old Forest (101+ years old)	374,900	47%
Total	789,600	100%

The oak decline event changed forest composition and structure across approximately 300,000 acres of oak forests by eliminating approximately 50 percent of red oak overstory and midstory trees. Average stand density prior to the red oak borer epidemic was relatively high, with basal areas averaging 120 square feet per

acre. Most of these stands contained, on average, 80 to 100 overstory trees per acre with an understory layer of shade-tolerant hardwoods numbering in the thousands. Red oak comprised about 50 percent of the overstory trees. Red oak losses reduced the total stand basal area of the affected stands to about 70 square feet with often little to no red oak remaining in the overstory. Of the remaining overstory, white oaks make up only about 20 percent of the basal area. Red maple and dogwood make up a large percentage of the midstory and understory. These trees, which have been growing in full shade most of their lives, are now exposed to full sunlight and are rapidly responding with expanding canopies and increased foliage.

Based on 524 plots measured in 2001 in areas affected by oak mortality, quality advanced oak regeneration (seedlings greater than 2 feet in height) is lacking on more than 95 percent of the area. Adequate oak regeneration is not likely to become established without additional disturbance because 1) there are a limited number of red oak trees left in the stand to produce acorns, and 2) seedlings that do become established will suffer poor development and heavy mortality due to shading from the shade-tolerant understory and midstory trees already present.

Lack of advanced oak regeneration, especially on medium and high quality sites, is common throughout the eastern U.S., as well as on the Ozark-St. Francis National Forests. Some evidence suggests this lack of regeneration is a result of inadequate levels of ecological disturbance of the kind that put oaks at a competitive advantage relative to other tree species (e.g., periodic understory fire). Although acorns may sprout each year, few seedlings make it through the heavy competition from shade tolerant species without some disturbance that reduces density of competitors. Oaks have adventitious buds just below ground level that can survive a low intensity fire and allow resprouting. Maples and dogwoods do not have these adventitious buds and are more easily killed by burning (Johnston, 1999).

The oak trees that make up today's forests had their origins 80 to 100 years ago when residents routinely burned the woods. When the Forest Service took possession of these lands and began fire suppression, oak seedlings were in a competitive position to take over the sites. Today, however, in many cases they are not. Without adequate red oak regeneration, the significant changes to the composition of these forests caused by the oak mortality event will be come permanent to the detriment of many ecosystem components, including many species of wildlife, such as squirrel, deer, bear, and turkey, which rely on acorns as an important food source.

Management efforts to regenerate oak-dominated forests over the past few decades on the OSFNFs have included even-aged, two-aged, and uneven-aged silvicultural systems. Clearcutting (even-aged system) in the 1980s resulted in some oak-dominated stands; however, excessive competition from other tree species has left many of these areas with less than desired densities of oaks. The shelterwood method (for both even-aged and two-aged systems), which leave a percentage of the overstory in place, have been successful where adequate advanced oak regeneration was in place prior to regeneration cutting. The group selection method (uneven-aged system) has been mostly unsuccessful, resulting in many small openings occupied by

light seeded species such as maple. Regardless of silvicultural system, presence of adequate densities of quality advanced oak regeneration is critical to maintaining oak dominance in regenerating stands, especially on better sites.

Dry Oak Forest and Woodland

Affected Environment

The Dry Oak Forest and Woodland Community is comprised of forest and woodland with canopies dominated (> 50%) by post oak, blackjack oak, and/or black oak. It also includes forests and woodlands dominated (> 50%) by other oaks and/or hickories (typically white oak or northern red oak) where they occur on xeric and dry sites. Minor components (< 30% of canopy) of shortleaf pine may also be present.

This community is commonly found on xeric and dry sites, typical of ridges and steep south and west aspects. It may also be found on gentler slopes and flats where soil types result in xeric and dry conditions. This community may also occupy mesic sites where frequent fire has influenced community composition, resulting in dominance by post, blackjack, or black oaks.

This community is synonymous with the Ouachita-Ozark Dry Oak Woodland Ecological System (CES202.707) of NatureServe's International Ecological Classification Standard. For planning purposes, it has been defined as:

1. CISC Forest Types 11, 35, 43, 57 on all Land Types;
2. CISC Forest Types 53, 54, 55, 44, 47, 48, 49 where on the following Land Types:

    - Lower South Aspects, Middle South Aspects, and Upper South Aspects with site indices of 0 to 60,
    - Lower North Aspects, Middle North Aspects, and Upper North Aspects with site indices of 0 to 50,
    - Ridgetops, and
    - Flat lands with site indices of 0 to 60.

Historically, open woodland structure (10 to 60% canopy closure), created and maintained by periodic fire and grazing, was the predominate condition within this community. Areas of forest (> 60% canopy closure) were typically open (60 to 80% canopy closure). Due to fire suppression, closed-canopy forests (> 80% canopy closure) are now typical.

Especially when in a woodland structural condition, this community is important to viability of 20 species of viability concern, including the endangered Indiana bat and American burying beetle. It is also important for several game species including whitetail deer, wild turkey, black bear, northern bobwhite quail, and reintroduced elk. Northern bobwhite and red-headed woodpecker have been selected as MIS to help indicate effects to wildlife communities associated with restored woodlands.

Currently, the Dry Oak Forest and Woodland community occurs on approximately 351,000 acres of the Ozark National Forest, representing approximately 32 percent of forested acreage. The great majority (> 80%) of this forest community is in mature, closed-canopy condition (> 70 years old, > 80% canopy closure), although very little (< 1%) is old enough to be classified as possible old growth (> 110 years old; see Table 3-32). Open forests are not abundant and woodland conditions are very rare.

This community has been impacted by the recent severe oak decline event. Based on data gathered in areas affected by oak mortality, areas with desired levels of advanced oak regeneration are also rare. Prescribed fire levels are poor when viewed across the past decade, but have improved with recent expansion of the prescribed burning program.

Environmental Effects

Key factors, indicators, and benchmarks were identified and defined (Tables 3-32 and 3-33); see introduction to the "Major Forest Community" section of this document for general process description) to assess effects of alternatives on this community. In addition, northern bobwhite and red-headed woodpecker were selected as management indicator species to help indicate effects of management on restoration of woodlands within this community (see "Management Indicator Species" section for effects analysis).

Table 3-32: Key Factors and Indicators Used to Assess Effects to the Dry Oak Forest and Woodland Community from Forest Plan Alternatives - OSFNFs.

Key Factor/Indicator	Definition
Age Diversity	
Percent Mature	Percent of total community acreage that is mature (*> 70 years old) includes 42% of uneven-aged acreage.
Percent Possible Old Growth	Percent of total community acreage that is possible old growth (> 110 years old) includes 8% of uneven-aged acreage.
Percent Regenerating	Percent of total community acreage that is regenerating (0-10 years old) includes 8% of uneven-aged acreage.
Percent Regenerating and Young	Percent of total community acreage that is regenerating (0-10 years old) or young (11-40 years old) includes 33% of uneven-aged acreage
Percent with Desired Advance Oak Regeneration	Percent of mature forest acreage (over 70 years old and > 60% canopy closure) that supports more than 300 oak seedlings per acre over 2 feet in height.
Woodland Restoration	
Percent Woodland	Percent of total community acreage in woodland (> 40 years of age and with 10 to 60% canopy closure).

Table 3-32: Key Factors and Indicators Used to Assess Effects to the Dry Oak Forest and Woodland Community from Forest Plan Alternatives - OSFNFs. (Continued)

Key Factor/Indicator	Definition
Fire Regime	
Percent Burned	Percent of total community acreage that has been burned during any season within the past 7 years
Percent Burned in Growing Season	Percent of total community acreage that has been burned during the growing season (April 1 to October 15) within the past 7 years
Density of Older Forests	
Percent of Older Forests with Open Canopies	Percent of mid-aged forest (41-70 years old) and mature forest (*> 70 years old) that has canopy closure between 60 and 80%.

***> = Greater Than**

"Optimal" benchmarks for indicators related to age diversity were derived in part from reference conditions defined for "Western Dry-Xeric Oak" in the Fire Regime Condition Class Interagency Handbook (see www.frcc.gov). These reference conditions were developed using expert opinion and modeling. Reference conditions from this source generally agree with input received during consultation with ecology experts. "Optimal" benchmarks represent age class percentages that would occur with a balanced age distribution and average stand longevity of 150 years. This equivalent "rotation age" falls between the average age of senescence and maximum average age of both post oak and black oak (George Hopper, unpublished data, University of Tennessee; Loehle 1988), allowing for ample expression of old growth conditions within this community. At the same time, benchmarks provide for levels of regenerating and young forests that are adequate to sustain the community over time. "Optimal" benchmarks for fire regime and woodland restoration indicators were also derived from the Fire Regime Condition Class Handbook, and generally consistent with input from ecology experts.

Table 3-33: Benchmarks for Indicators Used to Assess Effects to the Dry Oak Forest and Woodland Community from Forest Plan Alternatives - Ozark NF.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Age Diversity	**Benchmarks**				
Percent Mature	<16	16-28	29-40	>40	53
Percent Possible Old Growth	<14	14-18	19-22	>23	27
Percent Regenerating	<3.3	3.3-4.5	4.6-5.5	>5.6	6.7
Percent Regenerating and Young	<14	14-18	19-22	>23	27
Percent with Desired Advance Oak Regeneration	<50	50-69	70-84	>85	100
Woodland Restoration	**Benchmarks**				
Percent Woodland	<18	18-32	33-44	>45	60

Table 3-33: Benchmarks for Indicators Used to Assess Effects to the Dry Oak Forest and Woodland Community from Forest Plan Alternatives - Ozark NF.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Fire Regime	**Benchmarks**				
Percent Burned	< 24	24-43	44-59	> 60	80
Percent Burned in Growing Season	< 8	8-14	15-19	> 20	26
Density of Older Forests	**Benchmarks**				
Percent of Older Forests with Open Canopies	< 24	24-43	44-59	> 60	80

Indicator values were projected and rated for 10 (Table 3-34) and 50 years (Table 3-35) under each alternative (see introduction to the "Major Forest Community" section of this document for general process description).

Under all alternatives and time frames, age class diversity remains weighted toward older forests. In all cases, mature forests remain abundant, with large surpluses above the "optimal" benchmark. Possible old growth forest, though limited in the short term, also becomes abundant over time as forests age; it exceeds the "optimal" benchmark after 50 years. In contrast, amount of regenerating and young forests remain below "good" benchmarks for all alternatives and time frames, except for Alternative D (Balanced Age Class Emphasis), which reaches the "good" benchmark in 50 years. Differences in effects to age diversity among alternatives are not great, reflecting the common influence of program constraints (budget, etc.), incorporated into the SPECTRUM model across alternatives. These constraints serve to similarly limit the number of acres that can be treated under each alternative regardless of how needs are prioritized.

Advanced oak regeneration, while improving under all alternatives over current condition, is expected to remain well below desired levels under all alternatives as a result of low levels of older forests in an open condition and generally moderate levels of prescribed burning. Most improvement in this indicator is expected under Alternatives C (Ecological Restoration Emphasis) and B (Goods and Services Emphasis), followed by Alternative E (Balanced Age Class/Ecological Restoration Mixed). Results indicate that under all alternatives, oak dominance is likely to decline in regenerated stands without careful selection of stands for regeneration and skillful use of preparatory treatments prior to regeneration cutting.
Plan alternatives affect the amount of oak woodland primarily through levels of treatments used to restore woodland structure. These treatments may include thinning by commercial timber sale, thinning by noncommercial silvicultural treatments, and prescribed fire. Woodland restoration levels remain "poor" across all alternatives in the short term and are improved to "fair" only for Alternatives C (Ecological Restoration Emphasis) and E (Balanced Age Class/Ecological Restoration Mixed). These two alternatives are the only ones to include large objectives for woodland restoration. Although restoration efforts are not able to restore conditions above the "good" benchmark over this time frame, outcomes under these alternatives still represent substantial improvement in the status of this ecological

condition, and would greatly enhance habitat conditions for several species of viability concern. As with forest regeneration, higher levels of woodland restoration are limited by program constraints, as well as other multiple uses and values.

Table 3-34: Values and Ratings of Indicators for Current and Expected Future Conditions within the Dry Oak Forest and Woodland Community after Implementing Plan Alternatives for 10 years - Ozark NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	88.3 V. Good	86.6 V. Good	84.9 V. Good	86.5 V. Good	85.7 V. Good	86.1 V. Good
Percent Possible Old Growth	0.1 Poor	0.2 Poor	0.2 Poor	0.2 Poor	0.2 Poor	0.2 Poor
Percent Regenerating	3.5 Fair	4.0 Fair	3.2 Poor	4.1 Fair	4.3 Fair	3.8 Fair
Percent Regenerating and Young	8.6 Poor	9.8 Poor	10.3 Poor	9.9 Poor	10.4 Poor	10.0 Poor
Percent with Desired Advance Oak Regeneration	< 5 Poor	Poor	Poor	Poor	Poor	Poor
Woodland Restoration	**Values/Ratings**					
Percent Woodland	0.1 Poor	0.1 Poor	0.2 Poor	6.6 Poor	0.1 Poor	6.6 Poor
Fire Regime	**Values/Ratings**					
Percent Burned	13 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned In Growing Season	7 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	**Values/Ratings**					
Percent of Older Forests with Open Canopies	7.1 Poor	6.2 Poor	12.7 Poor	7.0 Poor	8.9 Poor	7.8 Poor

Table 3-35: Values and Ratings of Indicators for Current and Expected Future Conditions within the Dry Oak Forest and Woodland Community after Implementing Plan Alternatives For 50 Years - Ozark NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	88.3 V. Good	73.4 V. Good	77.1 V. Good	74.2 V. Good	72.2 V. Good	76.6 V. Good
Percent Possible Old Growth	0.1 Poor	67.5 V. Good	69.1 V. Good	67.7 V. Good	65.9 V. Good	70.2 V. Good
Percent Regenerating	3.5 Fair	4.2 Fair	3.6 Fair	4.3 Fair	4.7 Good	3.8 Fair
Percent Regenerating and Young	8.6 Poor	18.5 Fair	14.7 Fair	17.3 Fair	19.2 Good	15.2 Fair
Percent with Desired Advance Oak Regeneration	< 5 Poor	Poor	Poor	Poor	Poor	Poor
Woodland Restoration	**Values/Ratings**					
Percent Woodland	0.1 Poor	0.4 Poor	0.7 Poor	33.0 Good	0.1 Poor	34.9 Good
Fire Regime	**Values/Ratings**					
Percent Burned	13 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned in Growing Season	7 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	**Values/Ratings**					
Percent of Older Forests with Open Canopies	7.1 Poor	6.0 Poor	13.5 Poor	9.2 Poor	9.6 Poor	9.9 Poor

Another measure useful for comparing effects of alternatives on oak woodland restoration is the acres allocated to the Oak Woodland Management Area, which emphasizes restoration of oak woodland structure and fire regimes. Alternatives C (Ecological Restoration Emphasis) and E (Balanced Age Class/Ecological Restoration Mixed) both greatly increase the acreage allocated to this management area over that under current management (Alternative A); other alternatives do not include use of this management area (Table 3-36).

Table 3-36: Acres Allocated to the Oak Woodland Management Area by Forest Plan Alternative - Ozark NF.

Oak Woodland Management Area	Alternatives				
	A	B	C	D	E
Acres allocated	30, 858	0	168,296	0	154,704

Fire regimes within this community are improved under all alternatives, even Alternative A (Current Management), which projects very recent increases in the current prescribed burning program into the future. Because of overall burn acres by

alternative, Alternative C covers the greatest proportion of ecological burning needs within this community, reaching very good benchmarks. Alternative E is next, reaching "good" levels; other alternatives only reach "fair" benchmarks.

Shortleaf Pine-Oak Forest and Woodland

The Shortleaf Pine-Oak Forest and Woodland Community is comprised of forest and woodland with canopies dominated (> 50%) by shortleaf pine. A variety of oaks, including post, blackjack, black, white, and northern red oaks, along with hickory, also are often found within the canopy and midstory. *Vaccinium* and bluestem grasses are typical understory components.

This community is commonly found on xeric and dry sites, typical of ridges and steep south and southwest aspects. It may also be found on gentler slopes and flats where soil types result in xeric and dry conditions. This community may also occupy mesic sites where periodic fire has influenced community composition, resulting in dominance by shortleaf pine and fire-tolerant oak species. This community is most abundant on the southern portions of the forest.

This community is synonymous with the Ouachita-Ozark Shortleaf Pine-Oak Forest and Woodland Ecological System (CES202.313) of NatureServe's International Ecological Classification Standard. It includes the CISC Forest Types 12, 25 and 32 on all Land Types.

Pine woodland (10 to 60% canopy closure with well developed grass and herbaceous understories) is often referred to as the shortleaf pine-bluestem grass ecosystem. Historically, woodland conditions, created and maintained by periodic fire and grazing, predominated within this community. Due to fire suppression over the last century, denser closed-canopy forests with a significant component of fire-intolerant hardwoods are now typical; the shortleaf pine-bluestem grass ecosystem has nearly disappeared from the landscape (Bukenhofer and Hedrick 1997). Today's dense forests are generally more susceptible to forest health threats such as southern pine beetle; however, insects and diseases are currently not a significant factor in this community in the Ozarks. Some species associated with these open grassy habitats have declined or been extirpated; many are limited today to temporary forest openings or road rights-of-way.

Tree ring chronology studies done on the Mark Twain, Ozark, and Ouachita National Forests indicate fire was an integral part of this forest community in pre-European times. Fire was a tool used by the Native Americans to burn fields in attempts to improve hunting and food gathering. When environmental factors were favorable, these fires burned especially intensely on south-facing slopes and in pine stands creating open woodlands and establishing grass/forb understories. Further evidence that this ecosystem existed on the Ozark lies in the fact that remains of elk and bison, both herbivores requiring large expanses of grasses, have been found in caves and bluff shelters of the Ozark NF. This evidence indicates that there was sufficient herbaceous habitat to sustain these species.

Establishing adequate shortleaf pine regeneration is often a problem in parts of the main division of the Ozark National Forest. In general, the Mt. Magazine District has little trouble establishing natural regeneration, while the Bayou and Buffalo Districts have great difficulty. This difference is due to increasing amounts of competition from hardwoods in the northern range of the national forest. Shortleaf pine seed crops are sporadic with good seed crops spaced about eight years apart (Shelton and Wittwer 2004). Without adequate clear mineral soil coinciding with the seed fall, natural regeneration success is usually marginal or inadequate.

Silvicultural systems used over the life of the current forest plan have included even-aged and uneven-aged systems. Clearcutting used in the early 1970s and mid 1980s have resulted in numerous even-aged shortleaf pine plantations scattered throughout the pine forest. Seed-tree and shelterwood cutting employed in the 1990s have met with mixed results due to the sporadic nature of pine seed production and high degrees of competition. Single-tree selection has been largely unsuccessful across the forest due to sporadic seed production and overstory shade. As a result of this heavy reliance on natural regeneration, many regenerated acres of the Ozark National Forest are now under-stocked with shortleaf pine. Additional reforestation efforts, including planting, have begun to restore these areas to more historical pine densities.

There are currently approximately 291,000 acres of this forest community on the Ozark National Forest, representing 26 percent of forested acreage. It does not occur on the St. Francis NF. This community has been managed extensively over the past 40 years resulting in relatively well balanced age classes; levels of mature, regenerating, and young forests are rated as good to very good (Table 3-52). Little, however, is currently old enough to be classified as possible old growth (> 100 years old). Mid-aged and mature forests are primarily closed canopied—the average acre within the moderate site classification contains approximately 90 to 110 square feet of basal area per acre of overstory pine and 10 to 40 square feet of midstory hardwoods. Open woodland conditions are estimated to occur on less than 2 percent of community acreage. Prescribed fire levels just meet the lower benchmark for "fair" conditions when viewed across the past decade, but have improved with recent expansion of the prescribed burning program.

Environmental Effects

Key factors, indicators, and benchmarks were identified and defined (Tables 3-37 and 3-38; see introduction to the "Major Forest Community" section of this document for general process description) to assess effects of alternatives on this community. In addition, northern bobwhite and brown-headed nuthatch were selected as management indicator species to help indicate effects of management on restoration of woodlands and open forests within this community (see "Management Indicator Species" section for effects analysis).

Table 3-37: Key factors and indicators used to assess effects to the Shortleaf Pine-Oak Forest and Woodland community from Forest Plan Alternatives - OSFNFs.

Key Factor/Indicator	Definition
Age Diversity	
Percent Mature	Percent of total community acreage that is mature (*> 70 years old) includes 42% of uneven-aged acreage.
Percent Possible Old Growth	Percent of total community acreage that is possible old growth (> 110 years old) includes 8% of uneven-aged acreage.
Percent Regenerating	Percent of total community acreage that is regenerating (0 to 10 years old) includes 8% of uneven-aged acreage.
Percent Regenerating and Young	Percent of total community acreage that is regenerating (0 to 10 years old) or young (11 to 40 years old) includes 33% of uneven-aged acreage
Woodland Restoration	
Percent Woodland	Percent of total community acreage in woodland (> 40 years of age and with 10 to 60% canopy closure).
Fire Regime	
Percent Burned	Percent of total community acreage that has been burned during any season within the past 5 years.
Percent Burned in Growing Season	Percent of total community acreage that has been burned during the growing season (April 1 to October 15) within the past 5 years
Density of Older Forests	
Percent of Older Forests with Open Canopies	Percent of mid-aged forest (41-70 years old) and mature forest (> 70 years old) that has canopy closure between 60 and 80%.

*> = Greater Than

"Optimal" benchmarks for indicators related to age diversity were derived in part from reference conditions defined for "Xeric Pine-Oak Woodlands, Western" in the Fire Regime Condition Class Interagency Handbook (see www.frcc.gov), which was developed using expert opinion and modeling. Reference conditions from this source generally agree with input received during consultation with ecology experts. "Optimal" benchmarks represent age-class percentages that would occur with a balanced age distribution and average stand longevity of 120 years. This equivalent "rotation age" falls between average age of senescence and maximum average age of shortleaf pine (George Hopper, unpublished data, University of Tennessee; Loehle 1988), allowing for ample expression of old growth conditions within this community. At the same time, benchmarks provide for levels of regenerating and young forests adequate to sustain the community over time. "Optimal" benchmarks for fire regime and woodland restoration indicators were also derived from the Fire Regime Condition Class Handbook, which generally agree with input from ecology experts.

Table 3-38: Benchmarks for Indicators used to assess effects to the Shortleaf Pine-Oak Forest and Woodland community from forest plan alternatives - Ozark National Forest.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Age Diversity	**Benchmarks**				
Percent Mature	<13	13-22	23-30	>30	42
Percent Possible Old Growth	<8	8-11	12-13	>13	17
Percent Regenerating	<4.2	4.2-5.7	5.8-7.0	>7.0	8.3
Percent Regenerating and Young	<16	16-22	23-27	>27	33
Woodland Restoration	**Benchmarks**				
Percent Woodland	<17	17-31	32-43	>43	58
Fire Regime	**Benchmarks**				
Percent Burned	< 24	24-43	44-59	> 60	80
Percent Burned in Growing Season	< 8	8-14	15-19	> 20	26
Density of Older Forests	**Benchmarks**				
Percent of Older Forests With Open Canopies	< 40	40-55	56-67	> 68	80

Indicator values were projected and rated for 10 (Table 3-39) and 50 years (Table 3-40) under each alternative (see introduction to the "Major Forest Community" section of this document for general process description).

Under all alternatives and time frames, mature forests remain abundant, with surpluses above the "optimal" benchmark. Possible old growth forest, though limited in the short term, also becomes abundant over time as forests age; it exceeds the "optimal" benchmark after 50 years under all alternatives. Amount of regenerating and young forests increases slightly under Alternative D (Balanced Age Class Emphasis) and declines slightly under Alternatives C (Ecological Restoration Emphasis) and E (Balanced Age Class/Ecological Restoration Mixed), resulting in these alternatives being below the "good" benchmark in 50 years. Lower levels of regeneration are due in part to higher levels of woodland restoration and forest thinning under these two alternatives.

Plan alternatives affect the amount of pine woodland, like oak woodland, primarily through levels of treatments used to restore woodland structure. These treatments may include thinning by commercial timber sale, thinning by noncommercial silvicultural treatments, and prescribed fire. Woodland restoration levels remain "poor" across all alternatives in the short term and are improved to "fair" only for Alternatives C (Ecological Restoration Emphasis) and E (Balanced Age Class/Ecological Restoration Mixed). These two alternatives are the only ones to include large objectives for woodland restoration. Although restoration efforts are not able to restore conditions above the "good" benchmark, outcomes under these alternatives still represent substantial improvement in status of this ecological condition, and would greatly enhance habitat conditions for several species of

viability concern. Higher levels of woodland restoration are limited by program constraints, as well as other multiple uses and values.

Another measure useful for comparing effects of alternatives on pine woodland restoration is the acres allocated to the Pine Woodland Management Area (3.A), which has as its emphasis restoration of pine woodland structure and fire regimes. Alternatives C (Ecological Restoration Emphasis) and E (Balanced Age Class/ Ecological Restoration Mixed) both greatly increase the acreage allocated to this management are over that under current management (Alternative A); other alternatives do not include use of this management area (Table 3-41).

Percent of mid-aged and mature forests in an open condition increases over time under all alternatives (Tables 3-39 and 3-40); however, only Alternatives A (Current Management), C (Ecological Restoration Emphasis), and E (Balanced Age Class/Ecological Restoration Mixed) result in percentages above the "good" benchmark.

Table 3-39: Values and Ratings of Indicators for Current and Expected Future Conditions Within the Shortleaf Pine-Oak Forest and Woodland Community After Implementing Plan Alternatives for 10 Years - Ozark National Forest.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	Values/Ratings					
Percent Mature	36.0 V. Good	43.2 V. Good	45.3 V. Good	46.0 V. Good	43.1 V. Good	44.9 V. Good
Percent Possible Old Growth	3.5 Poor	7.1 Poor	8.3 Poor	8.2 Poor	7.8 Poor	7.3 Poor
Percent Regenerating	6.4 Good	5.9 Good	5.5 Fair	4.4 Fair	7.7 V. Good	4.3 Fair
Percent Regenerating and Young	36.7 V. Good	29.7 V. Good	28.5 V. Good	27.5 V. Good	30.6 V. Good	28.0 V. Good
Woodland Restoration	Values/Ratings					
Percent Woodland	1.7 Poor	3.3 Poor	3.1 Poor	6.6 Poor	2.8 Poor	6.4 Poor
Fire Regime	Values/Ratings					
Percent Burned	24 Fair	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned in Growing Season	Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	Values/Ratings					
Percent of Older Forests with Open Canopies	10.3 Poor	27.9 Poor	20.7 Poor	23.8 Poor	17.9 Poor	29.7 Poor

Table 3-40: Values and Ratings of Indicators for Current and Expected Future Conditions Within the Shortleaf Pine-Oak Forest and Woodland Community After Implementing Plan Alternatives for 50 Years - Ozark National Forest.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	Values/Ratings					
Percent Mature	36.0 V. Good	52.7 V. Good	55.3 V. Good	60.8 V. Good	44.8 V. Good	60.8 V. Good
Percent Possible Old Growth	3.5 Poor	23.8 V. Good	26.1 V. Good	30.0 V. Good	16.2 V. Good	29.1 V. Good
Percent Regenerating	6.4 Good	6.9 Good	6.5 Good	5.4 Fair	8.6 V. Good	5.3 Fair
Percent Regenerating and Young	36.7 V. Good	24.7 Good	23.1 Good	18.6 Fair	31.5 V. Good	18.3 Fair
Woodland Restoration	Values/Ratings					
Percent Woodland	1.7 Poor	9.6 Poor	8.3 Poor	32.3 Good	7.0 Poor	32.1 Good
Fire Regime	Values/Ratings					
Percent Burned	24 Fair	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned in Growing Season	Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	Values/Ratings					
Percent of Older Forests with Open Canopies	10.3 Poor	72.4 V. Good	53.9 Fair	65.0 Good	38.6 Poor	82.1 V. Good

Table 3-41. Acres Allocated to the Pine Woodland Management Area by Forest Plan Alternative - Ozark National Forest.

Pine Woodland MA	Alternatives				
	A	B	C	D	E
Acres allocated	22,570	0	98,196	0	97,629

Fire regimes within this community are improved under all alternatives, even Alternative A (Current Management), which projects very recent increases in the current prescribed burning program into the future. As a result of overall burn acres by alternative, Alternative C covers the greatest proportion of ecological burning needs within this community, reaching very good benchmarks. Alternative E is next, reaching "good" levels; other alternatives only reach "fair" benchmarks.

Dry-Mesic Oak Forest

The Dry-Mesic Oak Forest Community is defined as forests with canopies dominated (> 50%) by oaks, but which are not on xeric or dry sites, and which are not dominated (> 50%) by post, blackjack, or black oaks (indicators of Dry Oak Forest and Woodland). Shortleaf pine comprises less than 50 percent of the canopy. Midstory and understory associates vary widely, but frequently include maple, dogwood, and hickory. This community is found on a variety of sites, ranging from dry to mesic. It may be found in a variety of topographical positions, including riparian areas.

This community is synonymous with the Ouachita-Ozark Dry-Mesic Oak Forest Ecological System (CES202.708) of NatureServe's International Ecological Classification Standard. It is defined as CISC Forest Types 53, 54, 55, 42, 44, 47, 48, 49, 52 when on Lower North Aspects, Middle North Aspects, and Upper North Aspects with site indices greater than 50, and when on Lower South Aspects, Middle South Aspects, and Upper South Aspects with site indices of greater than 60. These CISC Forest Types are also considered Dry-Mesic Oak Forest when found on floodplain sites.

The presence of oak dominance within this community suggests that at least moderate levels of ecological disturbance are characteristic of this community. Historically, this disturbance likely was caused predominately by periodic fire that created open midstory conditions favorable to establishment of oak regeneration. However, because of the variety of sites occupied by this community, the frequency and intensity of fire was variable, with corresponding variability in forest density. Ecological disturbances sufficient to maintain oak dominance may be regular or episodic. Due to fire suppression during much of last century, denser closed-canopy forests are now typical, and adequate oak regeneration is not present on many sites, especially mesic ones. These dense forest conditions are believed to have been an important factor in the susceptibility of this community to recent forest health threats, which have resulted in significant mortality of mature oak trees.

There are currently approximately 436,000 acres of this type on the Ozark National Forest, representing 40 percent of the forest. It does not occur on the St. Francis NF. Like Dry Oak Forest and Woodland, the great majority (> 80%) of this forest community is in mature, closed-canopy condition (> 70 years old, > 80% canopy closure), although none is currently old enough to be classified as possible old growth (> 110 years old; Table 3-44). Open forests are not abundant, and woodland conditions are very rare. Based on data gathered in areas affected by oak mortality, areas with desired levels of advanced oak regeneration are also rare. Prescribed fire levels are "poor" when viewed across the past decade, but have improved with recent expansion of the prescribed burning program.

Environmental Effects

To assess effects of alternatives on this community, key factors, indicators, and benchmarks were identified and defined (Tables 3-42 and 3-43; see introduction to the "Major Forest Community" section of this document for general process description). In addition, scarlet tanager, Acadian flycatcher, and cerulean warbler were selected as management indicator species to help indicate effects of management on this community (see "Management Indicator Species" section for effects analysis).

Table 3-42: Key factors and Indicators Used to Assess Effects to the Dry-Mesic Oak Forest Community from Forest Plan Alternatives - Ozark National Forest.

Key Factor/Indicator	Definition
Age Diversity	
Percent Mature	Percent of total community acreage that is mature (*> 70 years old) includes 42% of uneven-aged acreage.
Percent Possible Old Growth	Percent of total community acreage that is possible old growth (> 110 years old) includes 8% of uneven-aged acreage.
Percent Regenerating	Percent of total community acreage that is regenerating (0 to 10 years old) includes 8% of uneven-aged acreage.
Percent Regenerating and Young	Percent of total community acreage that is regenerating (0 to 10 years old) or young (11 to 40 years old) includes 33% of uneven-aged acreage.
Percent with Desired Advance Oak Regeneration	Percent of mature forest acreage (over 70 years old and greater than 60% canopy closure) that supports more than 300 oak seedlings per acre over 2 feet in height.
Fire Regime	
Percent Burned	Percent of total community acreage that has been burned during any season within the past 7 years
Percent Burned in Growing Season	Percent of total community acreage that has been burned during the growing season (April 1 to October 15) within the past 7 years.
Density of Older Forests	
Percent of Older Forests with Open Canopies or Canopy Gaps	Percent of mid-aged forest (41 to 70 years old) and mature forest (> 70 years old) that has canopy closure of between 60 and 80%.

*> = Greater Than

"Optimal" benchmarks for indicators related to age diversity were derived in part by combining reference conditions for "Western Mesophytic Forest" and "Oak-Hickory-Pine Forest," defined for the Fire Regime Condition Class Interagency Handbook (see www.frcc.gov). These reference conditions were developed using expert opinion and modeling and generally agree with input received during consultation with ecology experts. "Optimal" benchmarks represent age class percentages that would occur with a balanced age distribution and average stand longevity of 160 years. This equivalent "rotation age" falls between average age of senescence and maximum average age of white oak (George Hopper, unpublished data, University of Tennessee; Loehle 1988), allowing for ample expression of old growth conditions within this community. At the same time, benchmarks provide for levels of regenerating and young forests adequate to sustain the community over time. "Optimal" benchmarks for fire regime indicators were also derived from the Fire Regime Condition Class Handbook, which generally match input from ecology experts.

Table 3-43: Benchmarks for Indicators Used to Assess Effects to the Dry-Mesic Oak Forest Community from Forest Plan Alternatives - Ozark National Forest.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Age Diversity	**Benchmarks**				
Percent Mature	<17	17-30	31-41	>41	56
Percent Possible Old Growth	<10	11-12	13-15	>15	19
Percent Regenerating	<3.2	3.2-4.3	4.4-5.2	>5.2	6.2
Percent Regenerating and Young	<12	12-17	18-21	>21	25
Percent with Desired Advance Oak Regeneration	<30	30-54	55-74	>75	100
Fire Regime	**Benchmarks**				
Percent Burned	< 24	24-43	44-59	> 60	80
Percent Burned in Growing Season	< 8	8-14	15-19	> 20	26
Density of Older Forests	**Benchmarks**				
Percent of Older Forests With Open Canopies or Canopy Gaps	<30	30-41	42-50	>50	60

Indicator values were projected and rated for 10 (Table 3-44) and 50 years (Table 3-45) following implementation of each alternative (see introduction to the "Major Forest Community" section of this document for general process description).

As with Dry Oak Forest and Woodland, under all alternatives and time frames, age class diversity remains weighted toward older forests. In all cases mature forests remain abundant, with large surpluses above the “optimal” benchmark. Possible old growth forest, though absent in the short term, also becomes abundant over time as forests age; it exceeds the "optimal" benchmark under all alternatives after 50 years. Amount of regenerating and young forests is stable or increases from current under all alternatives over time, but remains below “good” benchmarks for most alternatives and time frames. Exceptions are Alternatives D (Balanced Age Class Emphasis), which reaches the "good" benchmark in 50 years for both younger forest indicators, and Alternatives A (Current Management) and C (Ecological Restoration) which score slightly above the "good" threshold for one of the two younger forest indicators. Differences in effects to age diversity among alternatives are not great, reflecting the common influence of program constraints (budget, etc.), incorporated into the SPECTRUM model across alternatives. These constraints serve to similarly limit the number of acres that can be treated across all alternatives.

Also similar to the Dry Oak Forest and Woodland community, advanced oak regeneration, while improving under all alternatives over current condition, is expected to remain well below desired levels under all alternatives as a result of low levels of older forests in an open condition and generally moderate levels of prescribed burning. Results indicate that under all alternatives, oak dominance is likely to decline in regenerated stands without careful selection of stands for regeneration and skillful use of preparatory treatments prior to regeneration cutting.

Fire regimes within this community are improved under all alternatives, even Alternative A (Current Management), which projects very recent increases in the current prescribed burning program into the future. As a result of overall burn acres by alternative, Alternative C covers the greatest proportion of ecological burning needs within this community, reaching very good benchmarks. Alternative E is next, reaching "good" levels; other alternatives only reach "fair" benchmarks.

Percent of older forests with open canopies or canopy gaps remains low and at "poor" levels across all alternatives. It is highest, however, under Alternative B (Production of Goods and Services Emphasis). Cumulatively, natural mortality is likely to thin and create canopy gaps within this community over time thereby increasing these percentages. However, for low intensity disturbances such as individual tree fall gaps, residual midstory trees will likely limit desired development of understories and oak regeneration, failing to sustain oak dominance within this community.

Table 3-44: Values and Ratings of Indicators for Current and Expected Future Conditions within the Dry-Mesic Oak Forest Community after Implementing Plan Alternatives for 10 Years - Ozark NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	90.3 V. Good	86.9 V. Good	85.2 V. Good	86.7 V. Good	85.9 V. Good	86.6 V. Good
Percent Possible Old Growth	0.0 Poor	0.0 Poor	0.0 Poor	0.0 Poor	0.0 Poor	0.0 Poor
Percent Regenerating	3.6 Fair	4.2 Fair	3.4 Poor	4.3 Fair	4.5 Good	3.9 Fair
Percent Regenerating and Young	8.6 Poor	9.9 Poor	10.3 Poor	10.0 Poor	10.5 Poor	9.9 Poor
Percent with Desired Advance Oak Regeneration	< 5 Poor	Poor	Poor	Poor	Poor	Poor
Fire Regime	**Values/Ratings**					
Percent Burned	11 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned In Growing Season	5 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	**Values/Ratings**					
Percent of Older Forests with Open Canopies or Canopy Gaps	6.8 Poor	5.8 Poor	12.6 Poor	6.1 Poor	8.6 Poor	6.3 Poor

Table 3-45: Values and Ratings of Indicators for Current and Expected Future Conditions within the Dry-Mesic Oak Forest Community after Implementing Plan Alternatives for 50 Years - Ozark National Forest.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	90.3 V. Good	73.4 V. Good	77.2 V. Good	73.7 V. Good	71.9 V. Good	76.0 V. Good
Percent Possible Old Growth	0.0 Poor	68.1 V. Good	69.7 V. Good	68.1 V. Good	66.1 V. Good	70.5 V. Good
Percent Regenerating	3.6 Fair	4.3 Fair	3.6 Fair	4.4 Good	4.8 Good	4.0 Fair
Percent Regenerating and Young	8.6 Poor	18.4 Good	14.5 Fair	17.8 Fair	19.3 Good	15.8 Fair
Percent with Desired Advance Oak Regeneration	< 5 Poor	Poor	Poor	Poor	Poor	Poor
Fire Regime	**Values/Ratings**					
Percent Burned	11 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned in Growing Season	5 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests						
Percent of Older Forests with Open Canopies or Canopy Gaps	6.8 Poor	5.9 Poor	13.5 Poor	4.5 Poor	9.6 Poor	4.8 Poor

Mesic Hardwood Forest

The Mesic Hardwood Forest Community is comprised of forests with canopies dominated (> 50%) by American beech, maple, and/or walnut. It also includes forests dominated by sweetgum, when not on floodplain sites. It may include a significant component of mesic oaks, basswood, and cucumbertree, among others. This community is commonly found on lower slopes and north aspects, but may also be found on riparian or floodplain sites.

This community is synonymous with the Ouachita-Ozark Mesic Hardwood Forest Ecological System (202.043) of NatureServe's International Ecological Classification Standard. It includes CISC Forest Types 50, 56, 69, 81, 82, 88 wherever they occur and Forest Type 58 everywhere but on floodplain sites.

Historically, this community was subject to long fire return intervals. It regenerated through a combination of gap phase dynamics, which favors shade tolerant species such as beech and maple, and less frequent larger disturbances that provided for persistence of less shade-tolerant species such as oaks. Forest structure is typically multi-storied. This community is especially important for amphibians, moist site plants, and species preferring well-developed midstories, large den trees, and downed wood.

There are currently approximately 7,000 acres (< 1% of Forest) of this type on the Ozark National Forest. It does not occur on the St. Francis National Forest.

Environmental Effects

This community occupies a relatively small proportion of the forest and is typically not expected to be the target of management actions under any alternative. Effects of all alternatives are expected to be similarly negligible. Therefore, key factors and indicators were not selected and analyzed. Although areas of this community may occur within prescribed burn blocks, fire is expected to enter these sites infrequently, if at all, with limited effects on vegetation. Regeneration of characteristic shade-intolerant species (beech and maple) is expected to primarily occur through natural gap phase dynamics, resulting in uneven-aged stands with old growth characteristics over time. Persistence of shade-intolerant components of the community (mesic oaks) will primarily be dependent on larger, more intensive natural disturbances, such as wind or ice storms.

Riparian Forest

The Riparian Forest Community is comprised of forests with canopies dominated (> 50%) by ash, elm, sycamore, river birch, sugarberry, cottonwood, and/or willow. It also includes forests dominated by sweetgum when on floodplain sites. Willow oak, laurel oak, and water oak may be components.

This community is commonly found on floodplains of larger streams and rivers. The Riparian Forest Community type should not be confused with the riparian ecological site type. Other communities, such as Dry-Mesic Oak Forest and Mesic Hardwood Forest, also may occur on riparian sites.

This community includes the forested associations within the Ouachita-Ozark Riparian Ecological System (CES202.703) of NatureServe's International Ecological Classification Standard. It includes CISC Forest Types 46, 62, 64, 65, 68, 71, 72, 73, 75, and 78 wherever they occur and Forest Type 58 only when it occurs on floodplain sites.

Historically, this community was subject to long fire return intervals. It regenerated through a combination of gap phase dynamics, and disturbance caused by floods. The prevalence of flooding as a regenerative disturbance accounts for the abundance of shade intolerant species within this community.

There are currently approximately 2,900 acres of this type on the Ozark National Forest, representing less than 1 percent of the Forest. It does not occur on the St. Francis National Forest.

Environmental Effects

As with the Mesic Hardwood Forest Community, the Riparian Forest Community occupies a relatively small proportion of the forest and is not expected to be

frequently the target of management actions under any alternative. This community will typically be managed under the direction for the Riparian Corridor Management Area (3.I). Effects of all alternatives on abundance, structure, and function of this community are expected to be similarly negligible. Therefore, key factors and indicators were not selected and analyzed. Although areas of this community may occur within prescribed burn blocks, fire is expected to enter these sites infrequently, if at all, with limited effects on vegetation. Regeneration of characteristic species is expected to primarily occur through natural gap phase dynamics and disturbance from flooding, although limited regeneration through vegetation management is permissible under all alternatives.

Loblolly Pine Forest

The Loblolly Pine Forest community is comprised of forests with canopies dominated by loblolly pine. Loblolly pine is not native to the Ozark or St. Francis National Forests; these forests represent plantations established outside of the natural range of this species. Although they are plantations, they have not typically been managed as monocultures. Therefore, diversity of other canopy species may range from low to high, and may include a variety of species.

This community is synonymous with the Loblolly Pine Planted Forest Association (CEGL007179) of NatureServe's National Vegetation Classification Standard. It includes CISC Forest Types 13 and 31.

There are currently 13,229 acres (1% of Forest) of this type on the Ozark National Forest. There are currently 137 acres (< 1% of Forest) of this type on the St. Francis National Forest. The great majority of Loblolly Pine Forest on the Ozark National Forest is less than 30 years old. All of these types on the St. Francis National Forest are in the 40- and 50-year age classes.

Environmental Effects

Although acreage of this community is relatively small, its presence is not consistent with the general emphasis of national forest management of maintaining diversity of native tree species and communities. While not often extremely invasive, loblolly pine can regenerate aggressively and crowd out native trees in some cases. For these reasons, the management objective under all alternatives is to restore loblolly plantations to native forest communities. This objective would be accomplished by managing existing plantations to maturity (70 to 90 years of age) at which time they would be converted to a native forest community appropriate to the site.

Based on this objective, the single key factor identified for this community is its total abundance, indicated by its acreage on each national forest. However, because a relatively small acreage is involved, this indicator is not critical to sustainability of any native systems or species. Therefore, benchmarks are liberally set at 75, 50, and 25 percent reduction of current acreage for "very good," "good," and "fair" levels, respectively (Table 3-46).

Table 3-46: Benchmarks for Indicators Used to Assess Effects to the Loblolly Pine Forest Community from Forest Plan Alternatives - Ozark and St Francis National Forests.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Total Abundance	**Benchmarks**				
Total Acres on Ozark NF	> 9,922	9,922 - 6,615	6,614 - 3,307	<3,307	0
Total Acres on St. Francis NF	> 103	103 - 69	68 - 34	<34	0

Rate of conversion of loblolly pine plantations is the same across all alternatives. No plantations reach maturity within 10 years, so no conversions occur. Within 50 years, all have been converted on the St. Francis National Forest. Because the majority of loblolly plantations on the Ozark are currently under 30 years of age, a large proportion of them would not be converted after 50 years (Tables 3-47 and 3-48).

Table 3-47: Values and Ratings of Indicators for Current and Expected Future Conditions within the Loblolly Pine Forest Community after Implementing Plan Alternatives for 10 Years - Ozark and St. Francis National Forest.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Total Abundance	**Values/Ratings**					
Total Acres on Ozark NF	13,229 Poor	13,229 Poor	13,229 Poor	13,229 Poor	13,229 Poor	13,229 Poor
Total Acres on St. Francis NF	137 Poor	137 Poor	137 Poor	137 Poor	137 Poor	137 Poor

Table 3-48: Values and Ratings of Indicators for Current and Expected Future Conditions within the Loblolly Pine Forest Community after Implementing Plan Alternatives for 50 Years - Ozark and St. Francis National Forest.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Total Abundance	**Values/Ratings**					
Total Acres on Ozark NF	13,229 Poor	8,838 Fair	8,838 Fair	8,838 Fair	8,838 Fair	8,838 Fair
Total Acres on St. Francis NF	137 Poor	0 V. Good	0 V. Good	0 V. Good	0 V. Good	0 V. Good

Loess Slope Forest

The Loess Slope Forest Community is found in the Crowley's Ridge region of the St. Francis National Forest. It is comprised of forests with canopies dominated (> 50%) by one or more of the following species: American beech, white oak, cherry bark oak, southern red oak, northern red oak, post oak, black oak, southern sugar maple, yellow poplar, or magnolia. It also includes forests dominated by sweetgum and red maple when occurring on upland sites. This community encompasses most forests

on upland sites on the St. Francis National Forest, but also may be found on mesic lowland sites. Soils are typically loess in nature, formed from wind-deposited silt from the Mississippi River.

This community includes the forested associations within the Mississippi River Alluvial Plain Loess Slope Forest Ecological System (CES203.037) of NatureServe's International Ecological Classification Standard. It includes CISC Forest Types 50, 53, 56, 58, 69, 81, 82, and 88 wherever they occur on the St. Francis National Forest.

Historically, this community was subject to variable disturbance regimes. Some portions, typically dominated by oaks, were subject to moderate fire return intervals (approximately 10 years on average), while others, typically dominated by beech and maple, experienced longer fire return intervals. Management emphasis is primarily on maintaining an oak component and limiting the proportion of yellow poplar, which aggressively regenerates in areas of open canopy that are not subject to fire. Kudzu is a common invasive non-native species. This community provides optimal habitat for butternut and climbing magnolia, both species of viability concern.

Yellow poplar is present in most of the area and will quickly invade disturbed areas. In the early 1960s and 1970s, numerous clearcuts were used to re-establish red oak and white oak because of their wildlife benefits. These areas quickly became stocked with yellow poplar to the detriment of oak regeneration. Today these stands are 30- to 40-year-old commercial-sized yellow poplar stands. Oak regeneration throughout this community is lacking due to the competitiveness of yellow poplar and other species in addition to the presence of kudzu and other invasive species.

There are currently approximately 16,200 acres, or 86 percent of the Forest, within this community on the St. Francis National Forest. It does not occur on the Ozark National Forest. The large majority of this forest community is in mature, closed-canopy condition (> 70 years old, > 80% canopy closure), although none is currently old enough to be classified as possible old growth (> 140 years old; Table 3-64). Open forests comprise a relatively small proportion of older forests. Advanced oak regeneration is rated as poor based on agency experience with yellow poplar competition. Prescribed fire levels are "poor" when viewed across the past decade, but have improved with recent expansion of the prescribed burning program.

Environmental Effects

To assess effects of alternatives on this community, key factors, indicators, and benchmarks were identified and defined (Tables 3-49 and 3-50; see introduction to the "Major Forest Community" section of this document for general process description). In addition, Acadian flycatcher has been selected as a management indicator species to help indicate effects of management on this community (see "Management Indicator Species" section for effects analysis).

Table 3-49: Key Factors and Indicators Used to Assess Effects to the Loess Slope Forest Community from Forest Plan Alternatives - St. Francis National Forest.

Key Factor/Indicator	Definition
Age Diversity	
Percent Mature	Percent of total community acreage that is mature (*> 70 years old) includes 42% of uneven-aged acreage.
Percent Possible Old Growth	Percent of total community acreage that is possible old growth (> 140 years old) includes 8% of uneven-aged acreage.
Percent Regenerating	Percent of total community acreage that is regenerating (0 to 10 years old) includes 8% of uneven-aged acreage.
Percent Regenerating and Young	Percent of total community acreage that is regenerating (0 to 10 years old) or young (11 to 40 years old) includes 33% of uneven-aged acreage.
Percent with Desired Advance Oak Regeneration	Percent of mature forest acreage (over 70 years old and > 60% canopy closure) that supports more than 300 oak seedlings per acre over 2 feet in height.
Fire Regime	
Percent Burned	Percent of total community acreage that has been burned during any season within the past 10 years.
Percent Burned in Growing Season	Percent of total community acreage that has been burned during the growing season (April 1 to October 15) within the past 10 years.
Density of Older Forests	
Percent of Older Forests with Open Canopies or Canopy Gaps	Percent of mid-aged forest (41 to 70 years old) and mature forest (> 70 years old) that has canopy closure between 60 and 80%.

***> = Greater Than**

"Optimal" benchmarks for indicators related to age diversity were derived in part from reference conditions defined for "Mixed Mesophytic Northeast" in the Fire Regime Condition Class Interagency Handbook (see www.frcc.gov), which was developed using expert opinion and modeling. Reference conditions from this source generally agree with input received during consultation with ecology experts. "Optimal" benchmarks represent age class percentages that would occur with a balanced age distribution and average stand longevity of 180 years. This equivalent "rotation age" falls between average age of senescence and maximum average age of white oak (George Hopper, unpublished data, University of Tennessee; Loehle 1988), allowing for ample expression of old growth conditions within this community. At the same time, benchmarks provide for levels of regenerating and young forests adequate to sustain the community over time. "Optimal" benchmarks for fire regime and woodland restoration indicators were also derived from the Fire Regime Condition Class Handbook, and generally agreed with input from ecology experts.

Table 3-50: Benchmarks for Indicators Used to Assess Effects to the Loess Slope Forest Community from Forest Plan Alternatives - Ozark National Forest.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Age Diversity	**Benchmarks**				
Percent Mature	<18	18-33	34-46	>46	61
Percent Possible Old Growth	<7	7-11	12-16	>16	22
Percent Regenerating	<2.8	2.8-3.7	3.8-4.6	>4.6	5.5
Percent Regenerating and Young	<7	7-11	12-16	>16	22
Percent with Desired Advance Oak Regeneration	<30	30-54	55-74	>75	100
Fire Regime	**Benchmarks**				
Percent Burned	< 24	24-43	44-59	> 60	80
Percent Burned in Growing Season	< 8	8-14	15-19	> 20	26
Density of Older Forests	**Benchmarks**				
Percent of Older Forests with Open Canopies or Canopy Gaps	<30	30-41	42-50	>50	60

Indicator values were projected and rated for 10 (Table 3-51) and 50 years (Table 3-52) following implementation of each alternative (see introduction to the "Major Forest Community" section of this document for general process description).

Under all alternatives and time frames, mature forests remain abundant, with large surpluses above the "optimal" benchmark. Possible old growth forest, though limited in the short term, also becomes abundant over time as forests age; it exceeds the "optimal" benchmark after 50 years. Percent regenerating and young forests increase across all alternatives and time frames, reaching "good" or "very good" benchmarks within 50 years, except for Alternative B (Production of goods and Services Emphasis), which remains stable at the "fair" level for regenerating forests.

Advanced oak regeneration, while improving under all alternatives over current condition, is expected to remain well below desired levels under all alternatives as a result of low levels of older forests in an open condition and generally moderate levels of prescribed burning. Results indicate that under all alternatives, oak dominance is likely to decline in regenerated stands without careful selection of stands for regeneration and skillful use of preparatory treatments prior to regeneration cutting.

Fire regimes within this community are improved under all alternatives, even Alternative A (Current Management), which projects very recent increases in the current prescribed burning program into the future. As a result of overall burn acres by alternative, Alternative C covers the greatest proportion of ecological burning needs within this community, reaching very good benchmarks. Alternative E is next, reaching "good" levels; other alternatives only reach "fair" benchmarks.

Percentage of older forests with open canopies or canopy gaps remains low and at "poor" levels across all alternatives. It is highest, however, under Alternative B (Production of Goods and Services Emphasis). Cumulatively, natural mortality is likely

to thin and create canopy gaps within this community over time thereby increasing these percentages. However, for low intensity disturbances such as individual treefall gaps, residual midstory trees will likely limit desired development of understories and oak regeneration, failing to sustain oak dominance within this community.

Table 3-51: Values and Ratings of Indicators for Current and expected Future Conditions within the Loess Slope Forest Community after Implementing Plan Alternatives for 10 Years - Ozark National Forest.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	89.8 V. Good	86.2 V. Good	84.5 V. Good	86.4 V. Good	85.6 V. Good	86.7 V. Good
Percent Possible Old Growth	0.0 Poor	2.0 Poor	2.0 Poor	2.2 Poor	2.2 Poor	2.2 Poor
Percent Regenerating	3.6 Fair	4.5 Good	3.6 Fair	4.2 Good	4.4 Good	3.8 Good
Percent Regenerating and Young	9.1 Fair	10.6 Fair	11.0 Fair	10.4 Fair	10.9 Fair	10.0 Fair
Percent with Desired Advance Oak Regeneration	< 5 Poor	Poor	Poor	Poor	Poor	Poor
Fire Regime	**Values/Ratings**					
Percent Burned	14 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned in Growing Season	7 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	**Values/Ratings**					
Percent of Older Forests with Open Canopies or Canopy Gaps	5.8 Poor	4.9 Poor	11.6 Poor	5.1 Poor	7.5 Poor	4.6 Poor

Table 3-52: Values and Ratings of Indicators for Current and expected Future Conditions within the Loess Slope Forest Community after Implementing Plan Alternatives for 50 Years - Ozark NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	89.8 V. Good	73.5 V. Good	76.9 V. Good	74.8 V. Good	73.5 V. Good	76.7 V. Good
Percent Possible Old Growth	0.0 Poor	68.4 V. Good	69.6 V. Good	69.6 V. Good	67.7 V. Good	71.1 V. Good
Percent Regenerating	3.6 Fair	4.5 Good	3.6 Fair	4.2 Good	4.4 Good	3.8 Good
Percent Regenerating and Young	9.1 Fair	17.9 V. Good	14.5 Good	16.8 V. Good	17.8 V. Good	15.3 Good
Percent with Desired Advance Oak Regeneration	< 5 Poor	Poor	Poor	Poor	Poor	Poor
Fire Regime	**Values/Ratings**					
Percent Burned	14 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Percent Burned in Growing Season	7 Poor	32 Fair	36 Fair	68 V. Good	40 Fair	54 Good
Density of Older Forests	**Values/Ratings**					
Percent of Older Forests with Open Canopies or Canopy Gaps	5.8 Poor	5.4 Poor	12.4 Poor	2.6 Poor	8.5 Poor	2.9 Poor

Bottomland and Floodplain Forest

The Bottomland and Floodplain Forest Community is comprised of forests on the St. Francis National Forest with canopies dominated (> 50%) by one or more of the following species: ash, elm, sugarberry, Nutall oak, overcup oak, willow oak, pecan, sycamore, river birch, silver maple, water hickory, honey locust, and/or other species indicative of floodplains and bottomlands. It also includes forests dominated by sweetgum and red maple when occurring on bottomland and floodplain sites. This community encompasses most forests on bottomland and floodplain sites on the St. Francis National Forest.

This community includes the forested vegetation associations within the Mississippi River High Floodplain (Bottomland) Forest Ecological System (CES203.196) and the Mississippi River Riparian Forest (CES203.190) of NatureServe's International Ecological Classification Standard. It includes CISC Forest Types 61, 62, 63, 64, 65, 67, 68, 71, 72, 73, 75, and 78 wherever they occur on the St. Francis NF.

Historically, this community was subject to relatively long fire return intervals. It regenerated primarily through a combination of gap phase dynamics, and disturbance caused by wind storms and flooding. However, canebrakes, a native rare community frequently imbedded within the Bottomland and Floodplain Forest, is enhanced by moderate fire return intervals. The prevalence of flooding as a

regenerative disturbance accounts for the abundance of shade intolerant species associated with riverfronts within this community.

There are currently approximately 2,500 acres (13% of the Forest) of this type on the St. Francis NF. It does not occur on the Ozark NF. Currently mature forests are abundant; however, none qualifies as possible old growth (Table 3-53). Regenerating forests are at low levels, but regenerating and young forests together are slightly above optimal indicating some movement over the last few decades towards a more balanced age distribution.

Environmental Effects

Although this community occupies relatively small acreage, it represents a relatively significant proportion of the St. Francis NF. Therefore, to assess effects of alternatives on this community, key factors, indicators, and benchmarks were identified and defined (Tables 3-53 and 3-54; see introduction to the "Major Forest Community" section of this document for general process description).

Table 3-53: Key Factors and Indicators Used to Assess Effects to the Bottomland and Floodplain Forest Community from Forest Plan Alternatives - St. Francis NF.

Key Factor/Indicator	Definition
Age Diversity	
Percent Mature	Percent of total community acreage that is mature (*> 70 years old) includes 42% of uneven-aged acreage.
Percent Possible Old Growth	Percent of total community acreage that is possible old growth (> 110 years old) includes 8% of uneven-aged acreage.
Percent Regenerating	Percent of total community acreage that is regenerating (0 to 10 years old) includes 8% of uneven-aged acreage.
Percent Regenerating and Young	Percent of total community acreage that is regenerating (0 to 10 years old) or young (11 to 40 years old) includes 33% of uneven-aged acreage.

***> = Greater Than**

"Optimal" benchmarks for indicators related to age diversity were derived in part from reference conditions defined for "Southern Floodplain Forest" in the Fire Regime Condition Class Interagency Handbook (see www.frcc.gov), which was developed using expert opinion and modeling. Reference conditions from this source generally agree with input received during consultation with ecology experts. "Optimal" benchmarks represent age class percentages that would occur with a balanced age distribution and average stand longevity of 190 years.

Table 3-54. Benchmarks for Indicators Used to Assess Effects to the Bottomland and Floodplain Forest Community from Forest Plan Alternatives - St. Francis National Forest.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Age Diversity	**Benchmarks**				
Percent Mature	*<32	32-44	45-54	55	65
Percent Possible Old Growth	<24	24-32	33-40	*>40	47
Percent Regenerating	<3.7	3.7-4.4	4.5-5.0	>5.0	5.3
Percent Regenerating and Young	<10	11-14	15-18	>18	21

***< = Less Than**
***> = Greater Than**

Indicator values were projected and rated for 10 (Table 3-55) and 50 years (Table 3-56) following implementation of each alternative (see introduction to the "Major Forest Community" section of this document for general process description).

Under all alternatives and time frames, mature forests remain abundant at "very good" benchmark levels. Possible old growth forest, though currently limited, reaches "good" or "very good" benchmarks within the first decade, and remains so over the 50-year analysis period. Percentages of regenerating and young forests improve to "very good" levels under Alternatives A (Current Management) and B (production of Goods and Services Emphasis) in both the short and long term, but decline to very low levels under the other alternatives.

Table 3-55: Values and Ratings of Indicators for Current and Expected Future Conditions within the Bottomland and Floodplain Forest Community after Implementing Plan Alternatives for 10 years - St. Francis NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	56.9 V. Good	66.5 V. Good	67.1 V. Good	72.9 V. Good	73.0 V. Good	72.6 V. Good
Percent Possible Old Growth	0.0 Poor	38.2 Good	38.4 Good	43.0 V. Good	43.2 V. Good	42.8 V. Good
Percent Regenerating	3.3 Poor	6.5 V. Good	5.9 V. Good	0.2 Poor	0.0 Poor	0.4 Poor
Percent Regenerating and Young	22.9 V. Good	25.8 V. Good	25.2 V. Good	19.5 V. Good	19.4 V. Good	19.8 V. Good

Table 3-56: Values and Ratings of Indicators for Current and Expected Future Conditions within the Bottomland and Floodplain Forest Community after Implementing Plan Alternatives for 50 years - St. Francis NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Age Diversity	**Values/Ratings**					
Percent Mature	56.9 V. Good	56.1 V. Good	59.1 V. Good	87.7 V. Good	88.6 V. Good	86.5 V. Good
Percent Possible Old Growth	0.0 Poor	42.6 V. Good	44.8 V. Good	72.2 V. Good	73.0 V. Good	70.9 V. Good
Percent Regenerating	3.3 Poor	6.5 V. Good	5.9 V. Good	0.2 Poor	0.0 Poor	0.4 Poor
Percent Regenerating and Young	22.9 V. Good	25.9 V. Good	23.6 V. Good	0.7 Poor	0.0 Poor	1.7 Poor

RARE AND SPECIAL COMMUNITIES

Rare and special communities are assemblages of plants and animals that typically occupy a small proportion of the landscape, but which contribute significantly to plant and animal diversity because of the number of rare species associated with them. They typically are limited in number of occurrences, are small in size, and have relatively discrete boundaries. Because these communities are so important to meeting requirements for plant and animal diversity, most direction for their management is the same under all alternatives. All alternatives emphasize enhancing contribution of these communities to providing for diversity of plant and animal communities, recovering threatened and endangered species, and maintaining species viability. The only differences among alternatives with regard to these communities are objectives for restoration of two of these communities.

Like major forest communities, these communities have been identified and defined primarily using the International Ecological Classification Standard (NatureServe 2003, 2004, 2005) developed by NatureServe. In some cases, community names and definitions have been modified from the Draft EIS to better correspond with this classification standard. Community names have been simplified from this standard for clarity in presentation and ease of use. In a few cases, ecological systems have been lumped or split to better meet planning needs (Table 3-57).

Table 3-57: Rare and Special Communities on the OSFNFs.

Rare Communities/Ozark NF
Glades and Barrens
Montane Oak Forest
Cliff and Talus
Sinkhole and Depression Ponds
Seeps and Fens
Canebrakes
Caves, Mines, and Karst
Emergent Wetlands
Native Grasslands
Rare Communities/St. Francis NF
Bottomland Depression
Canebrakes
Emergent Wetlands

Analysis of effects to these communities follows the same general methods used for major forest communities. However, rare and special communities are a relatively new area of focus for planning on the OSFNFs. Therefore, current inventory and condition information for some of these communities is sparse. For this reason, detailed analysis of multiple key factors for each of these communities would be highly speculative and of limited value. To simplify analysis for these communities, the only indicator identified for most of them is the percent of all occurrences that are at "desired condition" as described generally in the proposed forest plan and defined more specifically during implementation of the inventory and monitoring program. Current qualitative ratings (poor, fair, good, very good) of this indicator are estimated by agency biologists based on their general knowledge of field conditions and the amount of historical management attention given to each community type. Similarly, qualitative ratings are estimated for 10 and 50 years under each alternative, based on the extent of threats and management needs within each community. This relatively coarse analysis is deemed sufficient because 1) these communities are highlighted for protection and optimal management under all alternatives, resulting in similarly improved conditions in all cases, and 2) plan direction includes a priority of improving inventory and monitoring of abundance and condition of these communities, providing better assessment of these communities as the plan is implemented.

Benchmarks for percent of occurrences at desired condition are set using the highest standard percentages reserved for rare elements: more than 95 percent for "very good," 85 to 95 percent for "good," 70 to 84 percent for "fair," and less than 70 percent for "poor." Elements of desired conditions to be monitored include:

- Presence of characteristic species, including those of viability concern,
- Structure of vegetation,
- Appropriateness of current disturbance regime (e.g., fire return interval),
- Presence and threat level of non-native invasive species, and
- Presence and threat of degradation from non-target management actions and recreational uses.

In general, on the national forest, these communities will continue to be threatened to varying degrees under all alternatives by some combination of degradation by recreational uses and/or non-targeted management actions, inappropriate ecological disturbance regimes, and invasion by non-native species. Plan direction under all alternatives is designed to minimize these threats and focus management activities to the extent practicable on active restoration and maintenance where needed. Results for rare communities are summarized in Tables 3-58 and 3-59.

Cumulatively, when considered across the Ozark ecoregion, prime examples of the rare and special communities considered here are uncommon and are threatened by development, conversion, non-native invasive species, and inappropriate disturbance regimes. Where not identified and protected by conservation agencies and organizations, these occurrences are highly threatened and not likely to persist as fully functioning systems to the end of the 50-year planning horizon. This situation makes conservation of these communities on NF land critical to sustaining them on the landscape, and to maintaining their function in supporting native biological diversity. The importance of national forest management is expected to increase with time, as national forest inventories and restoration efforts improve and private land examples of these communities are subject to increasing pressures or neglect.

Table 3-58: Ratings of Indicators for Current and Expected Future Conditions within Rare and Special Communities after Implementing Plan Alternatives for 10 Years - OSFNFs.

Indicator	Current	Alternatives				
		A	B	C	D	E
Community	**Ratings**					
Percent of Glades and Barrens at Desired Condition	Poor	Fair	Fair	Fair	Fair	Fair
Percent of Montane Oak Forest at Desired Condition	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Cliff and Talus at Desired Condition	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Sinkhole and Depression Ponds at Desired Condition	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Seeps and Fens at Desired Condition	Fair	Good	Good	Good	Good	Good
Acres of Canebrakes Restored	Poor	Poor	Poor	Poor	Poor	Poor
Percent of Caves, Mines, and Karst at Desired Condition	Good	Good	Good	Good	Good	Good

Table 3-58: Ratings of Indicators for Current and Expected Future Conditions within Rare and Special Communities after Implementing Plan Alternatives for 10 Years - OSFNFs. (Continued)

Indicator	Current	Alternatives				
		A	B	C	D	E
Community	Ratings					
Percent of Emergent Wetlands at Desired Condition	Fair	Good	Good	Good	Good	Good
Acres of Native Grassland Restored	Poor	Poor	Poor	Poor	Poor	Poor
Percent of Bottomland Depressions at Desired Condition	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good

Table 3-59: Ratings of Indicators for Current and Expected Future Conditions within Rare and Special Communities after Implementing Plan Alternatives for 50 Years - OSFNFs.

Indicator	Current	Alternatives				
		A	B	C	D	E
Community	Ratings					
Percent of Glades and Barrens at Desired Condition	Poor	Good	Good	Good	Good	Good
Percent of Montane Oak Forest at Desired Condition	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Cliff and Talus at Desired Condition	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Sinkhole and Depression Ponds at Desired Condition	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Seeps and Fens at Desired Condition	Fair	V. Good	V. Good	V. Good	V. Good	V. Good
Acres of Canebrakes Restored	Poor	Poor	Poor	Poor	Poor	Poor
Percent of Caves, Mines, and Karst at Desired Condition	Good	Good	Good	Good	Good	Good
Percent of Emergent Wetlands at Desired Condition	Fair	Good	Good	Good	Good	Good
Acres of Native Grassland Restored	Poor	V. Good	V. Good	V. Good	V. Good	V. Good
Percent of Bottomland Depressions at Desired Condition	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good

Glades and Barrens

These communities are characterized by thin soils and exposed parent material that result in localized complexes of bare soil 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. They vary in species composition depending on the type of underlying parent material, which may be acidic or calcareous. Field delineations of these communities include the entire complex of characteristic vegetation composition and structure, and where practicable connecting woodlands. Primary management needs are protection from non-target management disturbance and recreational impacts. Periodic vegetation management, especially prescribed fire, may be necessary to maintain or restore desired herbaceous and/or shrubby composition. These communities are comprised

of the following Ecological Systems as defined by NatureServe: Central Interior Highlands Calcareous Glades and Barrens (CES202.691) and Central Interior Highlands Dry Acidic Glades and Barrens (CES202.692).

These communities harbor a variety of desert-adapted species that do not occur in other habitats in the Ozark-Ouachita Ecoregion. These plants and animals are remnants of a period spanning approximately 8,000 years that was hotter and dryer than today's climate. Glades serve an important role for the desert-adapted species and help bring diversity to the region.

Glades have been maintained in this grass-forb-shrub condition by drought and periodic fire. The policy of fire protection that helped restore forests to the ecoregion during the 1900s has lead to invasion of glade habitats by fire-intolerant species (e.g., eastern red cedar) as well as expansion of fire-adapted trees into glade communities. This has lead to reduced populations and, in some cases, loss of glade species and collapse of the glade community.

Woodland habitats and talus areas often connect glades allowing for species movement among glades. Research has shown that this is the case with the collared lizard, a glade obligate. This species will not travel through the shaded conditions found in forests, isolating the lizards into small patches of habitat that make them vulnerable to local extirpation. Due to the fire prevention, this species has disappeared from many of the glades that they once inhabited. Restoration of woodlands in areas between glades is expected to allow re-colonization of some of these glades.

Trelease's larkspur, bush's yellow coneflower, and small-headed pipewort are other species of viability concern found in glades. Many animals that are not glade-dependent use glade habitats for critical periods of their lives. Wild turkeys use glades for brood rearing.

Glades are especially vulnerable to damage by off-highway vehicles (OHVs) and excessive recreational use.

The most extensive glades on the Ozark NF occur in the Springfield Plateau Area of the Sylamore Ranger District. Lands in the Boston Mountains and Arkansas River Valley Areas have more restricted glade systems usually associated with bluff line rock outcrops.

Currently, the percent of glade occurrences that are at desired conditions is estimated to be "poor" (< 70%), due to lack of regular fire and potential recreational impacts. Under all alternatives, this indicator is expected to improve to "fair" (70 to 84%) in the short term (10 years) and "good" (85 to 95%) in the long term (50 years). Improvement is expected due to the increases in prescribed burning program, and improved focus on ecological application of fire under all alternatives. In addition, monitoring is expected to identify where recreational uses are impacting this community, allowing application of remedial measures. "Very good" conditions may not be attainable because of legal and practical constraints on use of prescribed fire in some areas.

Montane Oak Forest

This system represents hardwood forests of the highest elevations of the Ouachita Mountains, including Mount Magazine. It is found on the Ozark NF only on Mount Magazine. Vegetation consists of either forests or open woodlands dominated by post oak, blackjack oak, white oak, and northern red oak. It differs from Dry Oak Forest and Woodland in that canopy trees are often stunted due to the effects of ice, wind, and cold conditions in combination with fog, shallow soils over rock, and periodic severe drought. Some stands form almost impenetrable thickets. This community is defined by NatureServe's Montane Oak Forest (CES202.306).

Currently, the percent of this community that is at desired conditions is estimated to be "good" (85 to 95%) because its few examples on Mt. Magazine have received management attention in recent years. It is expected that this indicator will remain stable or improve in both the short- and long-term under all alternatives because of the continued attention it will receive as a rare community. Because of its association with Mount Magazine State Park, recreational threats will remain.

Cliffs and Talus

Sandstone, limestone, dolomite outcrops, and talus distinguish these communities. Examples range from moist to dry. Cliff communities are characterized by steep, rocky, bluffs and slopes often above streams or rivers. They are typically sparsely vegetated, although some may be moderately well vegetated. Talus communities occur at the bases of steep cliffs, often along larger streams and rivers, or in strongly dissected valleys; soils are generally absent and vegetation is sparse to absent. Wind and water erosion, along with fire around the margins, are the primary natural dynamics influencing these communities. Field delineation of these communities includes zones at the top and base of cliffs. Primary management needs are protection from non-target management disturbance and recreational impacts. Periodic vegetation management, especially prescribed fire, may be necessary to limit encroachment by uncharacteristic vegetation. These communities are comprised of the following Ecological Systems as defined by NatureServe: Central

Interior Acidic Cliff and Talus (CES202.689) and Central Interior Calcareous Cliff and Talus (CES202.690).

Associated species of viability concern include Magazine Mountain shagreen (snail), western diamondback rattlesnake, timber rattlesnake, Ouachita leadplant, French's shooting star, and maple-leafed oak.

Currently, the percent of this community that is at desired conditions is estimated to be "good" (85 to 95%) because this community is generally low maintenance and relatively inaccessible to recreationists and nontarget management activity. This indicator is expected to remain stable or improve to "very good" (> 95%) as inventory and monitoring improves, and management needs are identified and addressed. Effects of management activities in the Cliffs and Talus Community would be primarily due to managing surrounding environments. Management of glades, woodlands, or forest communities surrounding or intergrading with talus areas should provide openness and fire regimes that are favorable to species associated with this community.

Sinkhole and Depression Ponds

These communities are naturally occurring upland ponds and wetlands. They occur in basins of sinkholes or other isolated depressions on uplands. Soils are very poorly drained, and surface water may be present for extended periods, rarely becoming dry. Water depth may vary greatly on a seasonal basis, and may be a meter deep or more in the winter. Some examples become dry in the summer. Soils may be deep (100 cm or more) consisting of peat or muck with parent material of peat, muck, or alluvium. Many of these ponds have their geologic origin as a more-or-less complete karst collapse feature. Some of them may display this geologic origin in a more explicit manner with definite walls and exposed limestone or dolomite at the surface ("sinkholes"). Others are more subtle, and exist as more gentle depressions with no exposed surface geology ("depression ponds"). Ponds vary from open water to herb-, shrub-, or tree-dominated systems. Tree-dominated examples typically contain various oaks including overcup and pin oak, sycamore, ash, silver maple, sweetgum, or black gum, or a combination of these. Buttonbush is a typical shrub component. Field delineation of these communities includes sufficient buffers to maintain hydrology. Primary management needs are protection from non-target management disturbance and recreational impacts. Periodic vegetation management, especially prescribed fire during dry periods, may be necessary to limit encroachment by uncharacteristic vegetation in herb- and shrub-dominated examples. This community is defined by NatureServe's Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018).

This community was likely much more abundant in the past, but has been impacted by conversion to permanent improved ponds, or filled at the time of settlement. They are very rare on the Forests today. These natural ponds provide islands of diversity in the uplands and are important for bottomland plants, amphibians (for breeding), and terrestrial animals (for drinking water). Some also get waterfowl use. Connections

with surrounding upland forests are important to maintaining use by breeding amphibians.

Currently, the percent of occurrences at desired condition is estimated to be "good" (85 to 95%) because these sites have been protected under the current forest plan. Some occurrences, however, may need maintenance to remedy encroachment by uncharacteristic vegetation. With improved monitoring and inventory, these needs would be identified and addressed. Therefore, this indicator is expected to improve to "very good" (> 95%) within 10 years, and to be maintained there over the long-term (50 years).

Seeps and Fens

These communities are typically found on side or lower slopes, the bases of bluffs, rock ledges, and terraces of streams and rivers. They are characterized by soils that are semi-permanently to permanently saturated as a result of groundwater seepage, and by the presence of wetland-associated species such as sedges, ferns, and sphagnum. Dominant vegetation may be herbs, shrubs, trees, or some complex of the three. Field delineation of these communities includes sufficient buffers to maintain hydrology. Downed wood in surrounding buffers are important as cover for associated animals. Primary management needs are protection from non-target management disturbance and recreational impacts. Periodic vegetation management, especially prescribed fire during dry periods, may be necessary to limit encroachment by uncharacteristic vegetation in herb- and shrub-dominated examples. These communities are defined by NatureServe as Ouachita Mountain Forested Seep (CES202.321) and Ozark-Ouachita Fen (CES202.052).

They are home to several salamanders with viability concerns. The Oklahoma graybelly, dark-sided, and many-ribbed salamanders find optimal conditions here. Portions of this community are also suitable for the Ozark zigzag, and Ouachita dusky salamanders.

Currently, the percent of occurrences at desired condition is estimated to be "fair" (75 to 84%) because some occurrences may have been adversely affected by management actions directed at other uses and values. With heightened attention given to these communities under all alternatives, this indicator is expected to improve to "good" within 10 years and “"very good" within 50 years, as time and directed management where needed work to recover affected occurrences. Because these communities are wet to moist most or all of the year, the increased prescribed fire under all alternatives is not expected to have large effects; however, fire is expected to affect the margins of this community by opening and renewing vegetation. This effect is presumably desirable as part of the natural disturbance regime to which these systems have been historically exposed.

Canebrakes

This community is characterized by almost monotypic stands of giant or switch cane (*Arundinaria gigantea*), usually with no or low densities of overstory tree canopy.

Typically, it is found in bottomlands or stream terraces. Although cane is found commonly as an understory component on many of these sites, treatment as a rare community is reserved only for larger patches (generally > 0.25 acres) exhibiting high densities that result in nearly monotypic conditions, or to areas selected for restoration of such conditions. Primary management needs are restoration and maintenance of areas already supporting a significant cane component through overstory reduction and prescribed fire on approximately 7 to 10 year intervals (Brantley and Pratt, 2001). Although several associations described by NatureServe (2001a, 2001b) include cane as a major component, this community most closely corresponds to Floodplain Canebrake (CEGL003836).

Species using this community include black bear and Swainson's warbler, which has the highest Partners-in-Flight species concern score of any bird on these national forests. It is believed that loss of this habitat type has impacted the Swainson's warbler populations range-wide.

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 Pratt 2001, Pratt and Brantley 1997). Large canebrakes are extremely rare today; therefore, it is critical to maintain and, where practical, restore these communities where they occur on Forest Service land.

Currently on the OSFNFs, there are essentially no examples of this community at desired conditions. Therefore, adding this community to the diversity of plant and animal communities on the forest will require targeted restoration. How much restoration of this type is ecologically desirable? During historical reference periods, canebrakes could occupy large areas of floodplain, possibly as a result of abandoned fields of Native Americans. Because restoration methods are not widely proven and riparian zones are so highly valued for other uses and values, restoration of canebrakes to historical levels is not feasible or socially desirable. However, some restoration of this native community is desirable to enhance community diversity and to develop experience in restoration methods. For this reason, relatively small canebrake restoration objectives are included under Alternatives C (Ecological Restoration Emphasis) and E (Balanced Age Class/Restoration Mix; Table 3-60).

Table 3-60: Canebrake Restoration Objectives (in Acres) for Forest Plan Revision Alternatives - OSFNFs.

Forest Unit	Alternatives				
	A	B	C	D	E
Ozark	0	0	100	0	50
St. Francis	0	0	50	0	25
Total	0	0	150	0	75

Because cane is widely distributed but there are few to no sites qualifying as prime examples, the indicator for this rare community differs from that used for the other rare communities. Instead of using percent of occurrences at desired condition, the indicator is the total number of acres restored to desired conditions. Benchmarks for

this indicator based on reference conditions are very high relative to both current and future conditions under any alternative. Therefore, current conditions and future outcomes in all cases are rated as "poor." Nevertheless, Alternatives C and E would result in improved conditions for this community; the other alternatives would not.

Caves, Mines, and Karst

These communities are characterized by natural and human-made openings in the ground that extend, for the most part, beyond the influence of sunlight and weather, creating habitats buffered from the surface environment. Included and inseparable from caves are karst features including sinkholes and sinking streams that lead to subterranean environments, and springs that flow from them. Surfaces of karstlands are directly linked to subterranean cave water systems and aquifers (Kastning and Kastning 1990). Caves in carbonate rocks are formed by a solution process that dissolves away rock by weak acid carried in groundwater as it seeps and flows through the subsurface rock. Underground aquatic systems contain their own community of organisms. Caves may contain a variety of microhabitats including streams, pools, wet stone, and mudflows along with dry rock and mud banks. Cave faunal assemblages vary widely within and between caves depending on microhabitats and history of connectivity between and within cave systems. Many bats are dependant on caves, both seasonally and year-round. Field delineation to the extent practicable includes buffers necessary to maintain subsurface hydrology, and quality of springs within the vicinity of spring sources. Primary management needs are protection from non-target management disturbance and recreational impacts, and maintenance of subsurface water quality and flow.

Caves on Ozark NF significantly contribute to the forest's biological diversity. Twelve species of viability concern are associated with this community, including five salamanders, two cavefish, three invertebrates, and two bats. Caves are sensitive to pollution, human disturbance, and changes in hydrology. Any one of these factors can change the ecology of a cave and affect species that live there.

Endangered bats inhabit several caves on the forest. Cave gates that exclude intruders have been placed on some caves that have had problems with disturbance. Generally, the larger a cave the greater the number of species it hosts. The most diverse cave on the Ozark NF is Blanchard Springs Caverns. Prior to development by the Forest Service, Blanchard Springs Caverns housed a gray bat hibernating colony of 5,000 to 7,000 individuals. Construction in the caverns began in 1963, and the cave was opened to the public in 1973. By the winter of 1978-1979, the hibernating colony decreased to 150 gray bats and reached a low of only 33 bats during the winter of 1985-1986. Since that winter, the USFS has limited disturbance at the roost site, which is located near the natural entrance. The bat population has increased dramatically to populations over ten times greater than pre-development populations (see analysis for the gray bat under the section on "Endangered Species").

Although caves on the Ozark NF have been studied and monitored intensely, much remains unknown. Access to caves is controlled through a permit system, which

takes into account the significance of the cave and the species present. Monitoring includes bio-inventories and bio-assessments on caves suspected to be biologically significant as well as counts of endangered species populations in caves with a history of harboring endangered species.

Caves, Mines, and Karst habitats are identified under all alternatives as rare communities to be protected. Protection measures are designed to curb pollution and prevent damaging levels of human disturbance and changes in hydrology.

Following monitoring protocols established in endangered species recovery plans will minimize detrimental effects to endangered species. Information gained from the surveys will allow managers to evaluate if steps being employed for the species are working.

Currently, the percent of occurrences meeting desired conditions is estimated to be "good" because caves have been a focus of management attention under the current plan. Additional inventories are needed for some caves, so a “"very good" rating is currently not warranted. Given the variety and types of threats to cave systems, attaining a "very good" rating (> 95% at desired conditions) for extended periods is unlikely; therefore, future outcomes under all alternatives are estimated to remain stable at "good" levels.

Emergent Wetlands

These communities include areas that maintain standing water throughout the year (or the majority of the year) and are not covered under other wetland rare or special communities described in this section. They include beaver impoundments, human-made ponds and waterholes, and shallows surrounding lakes and larger ponds that support emergent wetland vegetation. These communities are included here and classified as special because of their limited occurrence on the landscape and their value in providing for diversity of plants and animals. To some extent, they serve to replace natural depression ponds that may have been lost during settlement, and beaver activity that also is likely less than that present under reference conditions. However, because they typically have not been designed to mimic natural conditions, their locations, distribution, abundance, and condition may be outside the natural variation for habitats of this type. For these reasons, they are to be maintained as wetlands where practicable under all alternatives, but are not given the same level of priority for protection and maintenance as native rare communities, and may be modified as needed to meet multiple-use objectives.

Ponds serve many biological functions in uplands of the national forest. Vernal (temporary) ponds are extremely important to reproduction of amphibians, several species of which are of viability concern. Suitability for amphibian reproduction depends on structural conditions in the pond and length of time they hold water (hydro period). Different hydro periods provide for different amphibian species. Where they serve as important amphibian breeding areas, connections with mature forested uplands are important to allow migration to and from the ponds. Well-

traveled roads near these ponds can act as barriers and cause high levels of mortality to migrating amphibians. Downed wood in surrounding areas is important to provide cover for associated animals.

Permanent (year round) ponds provide water for terrestrial wildlife, which becomes critical during drought periods. This allows many species to survive in areas where they would not be able to live during droughts. Ponds increase the carrying capacity for many animal species. Ponds provide riparian zones that influence the growth of a variety of plants used by many wildlife species. They are very important for bats as a water and food (insect) source.
Because of the importance of this community to amphibians of viability concern, desired conditions used to assess the indicator for this community are focused on their suitability for supporting these species. Therefore, the indicator is the percent of occurrences that meet desired

Currently, ponds are not uncommon, as a result the current forest plan objective of providing two permanent ponds per section of land (640 acres) where year-round water is lacking. However, there are still areas of the OSFNFs that fall below this standard.

The percent of occurrences currently meeting desired conditions within this community is estimated to be "fair" (75 to 84%). Because of the number of species of viability concern in this group, emphasis is given (when making this estimate) to desired conditions relevant to breeding amphibians. The estimate of current condition reflects that areas immediately surrounding ponds may sometimes not be favorable to these species in terms of vegetation structure and presence of rock and log cover.

All alternatives continue the pond-building program on NF land and include monitoring and maintenance of existing ponds. Improved ecological sensitivity during construction, maintenance, and project planning for surrounding habitats are expected to improve conditions to "good" within 10 years, and maintain that level over the long-term. In addition, projects that include pond construction are expected to make greater consideration and be better informed on effects to rare communities such as Seeps and Fens, avoiding adverse effects that may have sometimes occurred in the past.

Native Grasslands

These communities are defined as areas greater than two acres in size with less than 10 percent canopy closure in trees dominated by a grassy ground layer that is comprised of more than approximately 50 percent cover in native plant species. These may be areas imbedded within pine and oak woodland, permanent openings within forest, or maintained fields or pastures. They are typically maintained with fire, but may also be maintained by other methods such as mowing and herbicide. These communities are rich in wildlife supporting an abundance of native grasses and

wildflowers, insects, ground-nesting birds, small mammals, and raptors and other predators. Primary management needs are restoring native species composition, and efficient maintenance in an open condition.

Historically, native grasslands occurred primarily as open areas scattered within oak woodland mosaics. Large areas of true grassland were not likely. Under plan alternatives, some areas of native grassland may be restored over time within woodland restoration areas where fire reduces overstories to grassland levels (< 10% canopy) in patches large enough to be mapped. However, additional opportunity exists to restore native grasslands to permanent pastures currently dominated with non-native grasses such as fescue. Like canebrake, restoration of this native grassland requires focused restoration efforts. Therefore, instead of using percent of occurrences at desired condition as an indicator for this community, the indicator used is the total number of acres restored to desired conditions.

Currently, approximately 7,072 acres are allocated to Management Area 3.J, Pastures and Large Wildlife Openings. An "optimal" ecological benchmark is to have all of these acres dominated by native grasses. Benchmarks for "very good," "good," "fair," and "poor" conditions are set using standard percentages for rare elements of the landscape (Table 3-61).

Table 3-61: Benchmarks for the native Grassland Restoration Indicator (Acres of Pasture Restored) - Ozark NF.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
Age Diversity	**Benchmarks**				
Total Acres in Native Grassland	<5,302	5,302-6,010	6,011-6,717	> 6,718	7,072

Restoration of native grasslands is part of current management on the Ozark NF. To date, nearly 1,000 acres have been restored. Approximately 200 acres are being restored each year. This rate of restoration is included under each alternative, but is doubled for Alternative C (Ecological Restoration Emphasis). This level of restoration results in considerable progress under all alternatives, although all indicators remain below the "poor" benchmark in the short-term (Table 3-62). In the long term, all alternatives would result in restoration of most or all of improved pastures, exceeding the "very good" benchmark.

Table 3-62: Values and Ratings of the Indicator for the Native Grassland Community after Implementing Plan Alternatives for 10 and 50 Years - Ozark NF.

Key Factor/Indicator	Current	Alternatives				
		A	B	C	D	E
Abundance of Native Grassland						
Total Acres in Native Grassland in 10 years	1,000 Poor	3,000 Poor	3,000 Poor	5,000 Poor	3,000 Poor	3,000 Poor
Total Acres in Native Grassland in 50 years	1,000 Poor	7,000 V. Good	7,000 V. Good	7,000 V. Good	7,000 V. Good	7,000 V. Good

Bottomland Depression

These communities include the swamps of the Mississippi River floodplain. They are characterized by semi-permanently flooded to saturated depressional areas within bottomland and floodplain sites. Typical dominant species include bald-cypress, water tupelo, and black willow. Primary management needs are maintenance of hydrologic regimes. These communities are defined by NatureServe's Lower Mississippi River Bottomland Depression (CES202.490).

Currently, percent of this community that is at desired conditions is estimated to be "very good" (> 95%) because this community is maintained primarily by Mississippi River flooding and has been relatively unaffected by recreationists and management activity in the surrounding Bottomland and Floodplain Forest Community. This indicator is expected to remain stable, even as management activity occurs within surrounding forests due to improved recognition and inventory of this rare community under all alternatives.

MANAGEMENT INDICATOR SPECIES

Affected Environment

National Forest Management Act (NFMA) regulations, adopted in 1982, require selection of management indicator species (MIS) during development of forest plans (36 CFR 219.19 [a]). Reasons for their selection must be stated. This section describes the MIS selected for the revised Land and Resource Management Plan and the conditions they are to represent. A more complete documentation of the MIS selection process is contained in the OSFNFs MIS process paper.

MIS are selected "because their population changes are believed to indicate the effects of management activities" (36 CFR 219[a][1]). They are used during planning to help compare effects of alternatives (36 CFR 219.19[a][2]), and as a focus for monitoring (36 CFR 219.19[a][6]). Where appropriate, MIS represent the following groups of species (36 CFR 219[a][1]):

- Threatened and endangered species on State and Federal lists;
- Species with special habitat needs;
- Species commonly hunted, fished, or trapped;
- Non-game species of special interest; and
- Species selected to indicate effects on other species of selected major biological communities.

Since adoption of these regulations, MIS concept has been reviewed and critiqued by the scientific community (Caro and O'Doherty 1999, Simberloff 1998, Noss 1990, Landres et al. 1988, and Weaver 1995). These reviews identify proper uses and limitations of the indicator species concept. They generally caution against overreaching in use of indicator species, especially when making inferences about ecological conditions or status of other species within a community. Caution is

needed because many different factors may affect populations of each species within a community, and each species' ecological niche within a community is unique.

To reflect this current scientific understanding while meeting the letter and spirit of regulations, we have made great effort to clearly define the legitimate uses and limitations of each selected MIS. The MIS process is but one tool used to develop management strategies and monitoring programs designed to meet NFMA requirements related to diversity of plant and animal communities. Other elements used for comprehensive planning for plant and animal diversity include: objectives and standards for maintenance and restoration of desired ecological conditions based on knowledge of overall ecosystem structure and function; biological evaluations and assessments at both the forest plan and site-specific project levels; and evaluation of risk to species of viability concern at the forest plan level. Other elements important to monitoring effects of plan implementation on plant and animal diversity include, where appropriate, monitoring of key ecological conditions; levels of management activities important to restoration and maintenance of community diversity; species assemblages (birds, bats, fish, etc.); harvest levels of game and other demand species; and populations of threatened, endangered, and sensitive species.

Effects of alternatives on terrestrial MIS were analyzed using a COMPATS (Computerized Project Analysis of Timber Sales) spreadsheet that totals habitat capability for each species. Forest stands are evaluated by their forest type, age, and treatments they have received such as thinning, wildlife stand improvement, prescribed fire, and site preparation. Additional improvements such as wildlife openings and ponds are also considered. Current habitat conditions are compared to predict habitat for each alternative at 10 and 50 years after implementation starts. Numbers of animals are estimates of habitat potential and not actual numbers of animals. Factors such as poaching and limiting conditions on wintering grounds are factors that may affect actual numbers.

In summary, 17 species were selected as MIS for the Revised Forest Plan. Fifteen are terrestrial species; two are aquatic species. They will be used to assess effects of alternatives and to help monitor results of implementing the selected alternative. Within specific major forest communities and terrestrial habitats, there is discussion of individual MIS and their expected response to each alternative. Viable populations of MIS are expected within all alternatives. However, the mix of habitat components by alternative will influence the degree to which increases or decreases are expected for each MIS.

Under the Revised Plan, the OSFNFs are moving to a community approach for monitoring aquatic species. Because of this method, only two aquatic species are included in the MIS species list. This community approach will involve looking at the fish community as a whole ecosystem and using tools like the Index of Biotic Integrity (IBI) to access conditions and evaluate trends in the aquatic community. The IBI will involve metrics, which will take into consideration fish characteristics like feeding

guilds, reproductive guilds, growth anomalies, and others. This method will allow the OSFNFs to better assess the overall health of the aquatic ecosystem.

Table 3-63 lists the Management Indicator Species for the OSFNFs and indicates the reasons each was chosen. Following Table 3-63 each species is discussed individually.

Table 3-63: Management Indicator Species Selected and Reason(s) For Selection.

Common Name	Ozark	St. Francis	Selection Criteria Indicators
Northern Bobwhite	X		Restoration of pine and oak woodland and native grasslands
Whitetail Deer	X	X	Meeting hunting demand for this species
Black Bear	X		Meeting hunting demand for this species
Wild Turkey	X	X	Meeting hunting demand for this species
Prairie Warbler	X		Regenerating forest communities on the Ozark NF
Yellow-breasted Chat		X	Regenerating forest communities on the St. Francis NF
Brown-headed Nuthatch	X		Open pine forest and woodland
Northern Parula	X	X	Communities associated with forests in riparian areas
Rufous-crowned Sparrow	X		Maintaining viability of this species through active maintenance of glades along bluff lines on Mt. Magazine
Cerulean Warbler	X	X	Communities associated with mature hardwood forest with complex canopy structures and Dry-Mesic Oak Forest communities on the Ozark NF
Ovenbird	X		On Dry-Mesic Oak Forests
Red-headed Woodpecker	X		Oak woodland overstories
Pileated Woodpecker	X	X	Large snags and snag-dependent wildlife on both forests
Scarlet Tanager	X		Forest interior bird communities and mature Dry-Mesic Oak Forest communities on the Ozark NF
Acadian Flycatcher	X	X	Forest interior bird communities on the St. Francis NF, and on mature mesic hardwood forest communities on both forests.
Smallmouth Bass	X		Meeting fishing demand for this species, and on cool-water stream communities
Largemouth Bass	X	X	Meeting fishing demand for this species

TERRESTRIAL MANAGEMENT INDICATOR SPECIES

Northern Bobwhite

Affected Environment

The northern bobwhite (quail or bobwhite) was selected as a MIS species because it represents a habitat condition that has declined severely in the last several decades. This habitat condition is important to a variety of plants and animals. Historically, quail thrived on lands that are now OSFNFs due to the significant amount of oak savanna, oak woodland, and glade habitat that was maintained by periodic fire.

Quail continued to thrive as land was settled, cut, grazed, and burned. The creation of small farms with shrubby edges provided adequate habitat for quail. As farms failed and fire prevention became the norm, a much thicker forest replaced forests maintained by open fire. Habitat conditions beneficial to quail and many other species began to decline.

Today, quail are rare on the forests except where restored glades, native fields, early seral forest, and thinned and burned forest conditions have been reestablished. These conditions are at historic lows on the forests.

Expected trends in quail habitat and populations are evaluated in terms of each alternative by tracking the amount of forest types and age class distribution, the silvicultural treatments used (including prescribed fire), and the amounts of pine-bluestem and savanna/woodland habitats that are maintained.

Direct, Indirect, and Cumulative Effects

Differences in alternatives result from changes due to several factors. These include natural succession, regenerating young forest stands, thinning older stands, restoring pine/oak woodland and savanna conditions, rotational burning, and construction of ponds and wildlife openings in selected forest communities.

See the "Demand Species" section for Bobwhite Quail on Page 3-284 for effects on this species.

Whitetail Deer

Affected Environment

Whitetail deer was chosen as a MIS due to its popularity as a hunting species. Tracking habitat conditions will indicate how much forest management is contributing to conditions needed for this game animal. Historically, deer browse was maintained mainly by fire. Glades, woodlands, and forests provided grasses, herbs, soft mast, and browse for deer. Woodlands and forests provided for hard mast requirements.

Expected trends in deer habitat and populations are evaluated in terms of each alternative by tracking the amount of forest types and age class distribution, the silvicultural treatments used (including prescribed fire), and the amounts of pine-bluestem and savanna/woodland habitats that are maintained.

Direct, Indirect, and Cumulative Effects

Differences in alternatives result from changes due to several factors. These include natural succession, regenerating young forest stands, thinning older stands, restoring pine/oak woodland and savanna conditions, rotational burning, and construction of ponds and wildlife openings in selected forest communities.

See the "Demand Species" section for whitetail deer on Page 3-277 for effects on this species.

Black Bear

Affected Environment

Black bear was chosen as a MIS due to its popularity as a hunting species. Tracking habitat conditions will indicate how much forest management is contributing to conditions needed for this game animal.

On the Forests, the preferred habitat for black bear are areas that are relatively isolated from disturbance and are comprised of mature hardwood, hardwood-pine, and pine-hardwood forest types that provide hard mast with 0 to 5-year-old regeneration areas and food plots intermixed. The regeneration areas provide cover; the regeneration areas and food plots provide forage and soft mast.

Arkansas Game and Fish Commission regulates black bear harvest based on population information and expert opinion of population size, including nuisance reports. Harvest quotas and number of animals harvested along with AGFC populations will be monitored as an indicator of how plan implementation is affecting black bear populations and associated hunting opportunities.

Direct, Indirect, and Cumulative Effects

See the "Demand Species" section for black bear on Page 3-287 for effects on this species.

Wild Turkey

Affected Environment

Wild turkey was chosen as a MIS due to its popularity as a hunting species and its need for a diverse mix of habitat types. Wild turkey was historically abundant on the forests. Habitat destruction and over hunting decimated populations in the early 1900s. Restocking efforts and habitat improvement have lead to increasing

populations for the last 30 years. Open areas with high insect populations are critical as brood rearing areas. Historically, glades pine-bluestem, and oak savanna areas provided this habitat. Recently constructed "natural openings", food plots, and forest regeneration areas have served this purpose.

Expected trends in wild turkey habitat and populations for each alternative are evaluated in terms of the amount of forest types and age class distribution, the silvicultural treatments used (including prescribed fire), and the amounts of pine-bluestem and savanna/woodland habitats that are maintained.

Direct, Indirect, and Cumulative Effects

See the "Demand Species" section for wild turkey on Page 3-282 for effects on this species.

Prairie Warbler

Affected Environment

Prairie warbler was chosen as a MIS due to its status as a Neotropical migratory bird of concern that has specialized habitat needs. Optimal habitat conditions for this species are even-aged regenerating forests of stand size or larger. Monitoring in the Ozark-Ouachita physiographic province shows a declining trend for this species.

Potential populations will be evaluated by tracking the amount of stand-sized early seral habitat and the amount of pine-bluestem and oak savanna/woodland habitats maintained in each alternative.

Direct and Indirect Effects

Analysis of the predicted effects of production of prairie warbler habitat on the Forests after one decade and five decades for each alternative is reported in Table 3-31. Differences in alternatives result from changes due to several factors. These include natural succession, regenerating young even-aged forest stands, and restoring pine/oak woodland and savanna conditions.

This analysis shows significant increases in habitat conditions over present conditions for all alternatives. Alternatives C, D, and E show the most gains followed by A and B. Percentages of increases are depicted in Table 3-64.

Table 3-64: Predicted Increase/Decrease in Prairie Warbler Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	+46%	+28%	+73%	+68%	+62%
5	+58%	+32%	+80%	+86%	+64%

Cumulative Effects

Private lands play an important role in providing habitat for this species; however, fluctuations in market prices affect amounts of early seral habitat produced on private lands more than it does on NF land. Regeneration on public land will play a significant role for this species especially when timber markets are down.

Yellow-Breasted Chat

Affected Environment

Yellow-breasted chat was selected to represent species needing early seral habitat conditions on the St .Francis National Forest. It occupies regenerating forest in small and large patch sizes.

Potential populations will be evaluated by tracking the amount of early seral habitat maintained on the St. Francis NF.

Direct and Indirect Effects

Analysis of the predicted effects of production of Yellow-breasted chat habitat on St. Francis NF after one decade and five decades for each alternative are found on Table 3-65 Alternatives A, D, and C show significant increases. Alternative E shows a slight increase with alternative B showing no change from current condition.

Table 3-65: Predicted Increase/Decrease in Yellow-Breasted Chat Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	+25%	No Change	+16.7%	+22.2%	+5.6%
5	+25%	No Change	+16.7%	+22.2%	+5.6%

Cumulative Effects

Private lands play an important role in providing habitat for this species on the Ozark NF but little private land is in timber production in or around St. Francis NF. Regeneration on NF lands will play a significant role for this species especially in Lee and Phillips Counties.

Brown-Headed Nuthatch

Affected Environment

Brown-headed nuthatch was chosen to represent species needing pine woodland condition. This species is currently rare on the Forests but should increase in numbers as pine woodland condition is restored.

Potential populations will evaluated by tracking the amount of pine woodland condition on the Forests.

Direct and Indirect Effects

Analysis of the predicted effects of production of brown-headed nuthatch habitat on the Forests after one decade and five decades for each alternative is shown in Table 3-66.

Table 3-66: Predicted Acres in Brown-Headed Nuthatch Habitat by Alternative.

Decade	Acres per Alternative					
	Current	A	B	C	D	E
	5,300					
1		10,200	9,400	20,300	8,600	19,500
5		29,800	25,900	100,100	21,800	99,500

Alternatives C and E, which are restoration alternatives, show significant increases in brown-headed nuthatch habitat. Alternatives A, B, and D show little progress.

Cumulative Effects

Private lands in or around Ozark-St Francis NFs is expected to contribute little to production of habitat for this species. NF lands will contain most of the suitable habitat for this species.

Northern Parula

Affected Environment

Northern parula was chosen to represent species needing riparian forest condition. They are common summer residents along the forests' wooded rivers and streams.

Potential populations will be evaluated by tracking mature riparian habitat on the Forests.

Direct and Indirect Effects

Analysis of the predicted effects of production of northern parula habitat on the Forests after one decade and five decades for each alternative is displayed in Table 3-67. All alternatives show significant increases in northern parula habitat after ten years of implementation. After 50 years, habitat for this species remains significantly increased for Alternatives E, D, and C. Alternative B returns to current levels and Alternative A shows about a 10 percent reduction from current levels. :

Table 3-67: Predicted Increase/Decrease in Northern Parula Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	+18.8	+18.4	+24.8	+24.7	+14.7
5	-9.9	+0.8	+24.7	+25.2	+29.2

Cumulative Effects

Private lands are expected to continue to provide suitable lands for this species on a moderate portion of the private riparian lands.

Acadian Flycatcher

Affected Environment

Acadian flycatcher was chosen to represent species needing mid-aged to mature forest stages of Loess Slope Forest found on Crowley's Ridge of St. Francis NF.

Potential populations will be evaluated by tracking mid-aged to mature Loess Slope Forest.

Direct and Indirect Effects

Analysis of the predicted effects of production of Acadian flycatcher habitat on the St. Francis NF after one decade and five decades for each alternative is displayed in Table 3-68. All alternatives show little change in Acadian flycatcher habitat after ten years of implementation. After fifty years, habitat for this species remains essentially at current levels for all alternatives except Alternative B, which shows a slight increase in Acadian flycatcher habitat.

Table 3-68: Predicted Increase/Decrease in Acadian Flycatcher Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	-0.3%	+1.1%	-0.4%	-0.6%	0
5	-0.5%	+5.3%	-1.4%	-1.2%	-0.5

Cumulative Effects

Private lands around the St. Francis NF are expected to provide little habitat for this species. Other lands along Crowley's Ridge should provide moderate amounts of habitat for the Acadian flycatcher.

Rufous-Crowned Sparrow

Affected Environment

Rufous-crowned sparrow is a common resident in the desert southwest but is very rare on the Forests and in Arkansas. It was chosen as an MIS to track habitat conditions for this species that require maintained glades along bluff lines.

Glades containing rufous-crowned sparrows will be tracked as maintained or not. The species is currently only known to reside on the Ozark NF at Mt. Magazine.

Direct and Indirect Effects

All alternatives propose managing glades associated with this species. Populations are expected to remain at low levels due to the limited amount of habitat available.

Cumulative Effects

Private and state lands are not expected to provide for this species unless catastrophic wildfires such as were experienced in 1980 provide temporary habitat as was created on Mt Nebo in 1980.

Cerulean Warbler

Affected Environment

Cerulean warbler was chosen as an MIS to represent species needing mature and over-mature forest with a complex canopy structure on highly productive sites.

Potential habitat will be tracked by calculating acres of forest age 70 and over that have a site index of 70 or over. The Forests will continue to work with local ornithologists to refine habitat evaluation for this species.

Effects of prescribed burning on occurrence of this species will be tracked.

Direct and Indirect Effects

Analysis of the predicted effects of production of cerulean warbler habitat on the Forests after one decade and five decades for each alternative is as follows in Table 3-69.

Potential cerulean habitat, as measured by abundance of mature forests on sites with indices over 70, is expected to decline slightly under all alternatives; however, total abundance and percent of mesic forests in mature condition remain very high in all cases (Table 3-36). The percent of mesic forests in a mature condition with canopy gaps is currently relatively low, and is expected to remain low under all alternatives, at least to the extent that it is affected by vegetation management. Additional acreage may be added to this condition over the long term as a result of

natural disturbance events and mortality of large canopy trees. The extent of this effect is uncertain due to the unpredictability of natural disturbance events and the lack of data relevant to older forest conditions, but would likely be similar across alternatives. Results presented here reflect only effects of management actions on creation of canopy gaps to highlight differences in management intensities across alternatives. Alternatives D and E increase acreage of mature mesic forests with canopy gaps primarily due to higher levels of uneven-aged management and thinning included under these alternatives.

Table 3-69: Effects to Cerulean Warbler Habitat by Alternative.

Decade	Alternatives					
	Current	A	B	C	D	E
Mature Mesic Forest						
% Change from Current—Decade 1	--	-3.6	-2.2	-3.6	-3.7	-3.1
% Change from Current –Decade 5	--	-18.6	-11.0	-17.1	-18.7	-14.4
Acres—Decade 1	290,400	280,000	284,000	280,000	279,700	281,500
Acres—Decade 5	290,400	236,500	258,300	240,700	236,000	248,600
% of Mesic Forest that is Mature --Decade 1	89.7	86.5	87.8	86.5	86.4	87.0
% of Mesic Forest that is Mature --Decade 5	89.7	73.1	79.8	74.4	72.9	76.8
Mature Mesic Forest with Canopy Gaps						
% Change from Current—Decade 1	--	-11.9	+95.8	-7.3	+30.8	-3.7
% Change from Current –Decade 5	--	-20.7	+100.5	-37.1	+32.4	-33.3
Acres—Decade 1	18,600	16,400	36,400	17,200	24,300	17,900
Acres—Decade 5	18,600	14,800	37,300	11,700	24,600	12,400
% of Mesic Forest that is Mature w/ Gaps--Decade 1	5.8	5.1	11.3	5.3	7.5	5.5
% of Mesic Forest that is Mature w/ Gaps--Decade 5	5.8	4.6	11.5	3.6	7.6	3.8

Cumulative Effects

The amount of cerulean warbler habitat on private lands will vary with the amount of development and market prices for hardwood timber. Reliable habitat for this species in and around the Forests is essentially restricted to state wildlife management areas, national forests, and the Buffalo National River.

Ovenbird

Affected Environment

Oven bird was selected to represent ground nesting birds in dry-oak and dry-mesic oak forests.

Potential populations will be evaluated by tracking hardwood forests and woodlands of age 40 and over. Effects of prescribed burning on occurrence of this species will be evaluated.

Direct and Indirect Effects

Analysis of the predicted effects of production of ovenbird habitat on the Forests after one decade and five decades for each alternative is shown in Table xx. It shows that ovenbird habitat will decline in all alternatives. After ten years, there will be a small decline in habitat. Alternative B shows a 5.9 percent decrease; Alternative C, 4.2 percent; and Alternatives A, D and E less than 4 percent. At 50 years, declines are greater due to better-balanced age classes or an increase in woodland habitat. Declines in Alternatives A, B, and C are close to 10 percent while Alternatives E and C decline 20 and 23 percent, respectively. Ovenbird habitat would still be common on the Forests in all alternatives.

Effects of fire may lower habitat conditions more than indicated by this analysis. Region 8 bird surveys will allow further analysis as the Plan is implemented. Effects of prescribed fire will need to be evaluated as Plan implementation progresses.

Analysis of the predicted effects of production of ovenbird habitat on the Forests after one decade and five decades for each alternative is shown in Table 3-70.

Table 3-70: Predicted Increase/Decrease in Ovenbird Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	-1.5%	-5.9%	-4.2%	-3.2%	-3.8%
5	-9.9%%	-10.3%	-22.7%	-12.3%	20%

Cumulative Effects

Habitat for ovenbird is currently common on private property in and around the Forests. Development and fluctuations due to changes in the market values in hardwood saw timber could affect habitat somewhat but should not affect this species as much as cerulean warbler. Habitat should continue to be plentiful in and around the Forests.

Red-Headed Woodpecker

Affected Environment

Red-headed woodpecker was selected to represent species requiring oak woodlands. This species is uncommon on the Forests at present but expected to increase as oak woodland condition is restored.

Pine woodlands also provide some habitat for this species but brown-headed nuthatch was chosen to evaluate progress in reestablishing pine woodlands.

Potential populations will be evaluated by tracking the amount of oak woodland maintained on the Forests.

Direct and Indirect Effects

Analysis of the predicted effects of production of Red-headed Woodpecker habitat on the Forests after one decade and five decades for each alternative is as follows in Table 3-71.

Table 3-71: Predicted Acres of Red-headed Woodpecker Habitat by Alternative.

Decade	Acres per Alternative					
	Current	A	B	C	D	E
	300					
1		500	700	22,00	300	22,000
5		1,300	2,200	110,000	500	116,000

Alternatives A, B, and D do little to produce lasting red-headed woodpecker habitat. Some habitat is expected in oak decline areas and seed tree areas but this only lasts for a short period. Alternatives C and E provide significant gains in red-headed woodpecker habitat. Additional gains should be realized in these two alternatives through increased growing season burns and burns in oak decline areas.

Cumulative Effects

Very little red-headed woodpecker habitat is expected to be provided on private lands. The bulk of habitat will be provided in woodland restoration areas on the National Forests.

Pileated Woodpecker

Affected Environment

This species was selected as a MIS to represent snag-dependent species and species requiring older forests. Breeding bird surveys in the Ozark-Ouachita physiographic province suggest that populations of the pileated woodpecker trended downward from the 1960s until the mid-1980s and have stabilized or trended

slightly upward since then. The recent episode of oak decline should provide a temporary spike in habitat for this species.

Population and habitat trends for this species are analyzed in terms of stand age and predicted snag abundance for each alternative.

Direct and Indirect Effects

Analysis of the predicted effects of production of pileated woodpecker habitat on the Forests after one decade and five decades for each alternative is reported in Table 3-72. Differences in alternatives result from changes due to several factors. These include natural succession, regenerating young forest stands, thinning older stands, restoring pine/oak woodland and savanna conditions, and rotational burning in selected forest communities.

This analysis shows decreases in most alternatives due to the large amount of older forest conditions presently occurring on the Forests.

Table 3-72: Predicted Increase/Decrease in Pileated Woodpecker Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	-3.1%	-2.2%	-5.1%	+1.4%	-4.5%
5	-5.9%	-2.5%	-6.5%	-8.8%	-4.5%

Cumulative Effects

Trends on private lands should be similar to NF lands except near growing population centers where loss of forests due to development should decrease habitat for this snag-dependent bird.

Scarlet Tanager

Affected Environment

Scarlet Tanager was selected as a MIS to represent species that require mature interior forest habitat. "Interior forest" is a term used for extensive forest tracts with little land in other uses such as agriculture or urban development. Breeding bird surveys in the Ozark-Ouachita physiographic province suggest that the scarlet tanager population has been increasing since the surveys began in 1967.

Population and habitat trends for the scarlet tanager are evaluated for each alternative in terms of changes in the number and types of forest age combinations produced and the silvicultural treatments used including prescribed fire.

Direct and Indirect Effects

Analysis of the predicted effects of production of scarlet tanager habitat on the Forests after one decade and five decades for each alternative is reported in Table 3-73. Differences in alternatives result from changes due to several factors. These include natural succession, regenerating young forest stands, thinning older stands, restoring pine/oak woodland and savanna conditions, and rotational burning in selected forest communities. Table 3-73 shows the increases or decreases depending upon alternatives

Table 3-73: Predicted Increase/Decrease in Scarlet Tanager Habitat by Alternative.

Decade	Alternatives				
	A	B	C	D	E
1	-1.6%	-1.3%	-2.3%	+3.2%	-2.3%
5	-2.9%	-1.6%	-3.6%	-3.9%	-2.9%

Cumulative Effects

Trends on private lands should be similar to NF lands except near growing population centers where loss of forests due to development should decrease habitat for this mature forest dependent bird. See "Migratory Birds" section for discussion on habitat fragmentation.

AQUATIC MANAGEMENT INDICATOR SPECIES

Smallmouth Bass

Affected Environment

This species was selected due to popularity as a sport fish and as an indicator of high quality stream habitat. Larger streams on the Forests such as Big Piney Creek, Mulberry River, and North Fork of Illinois Bayou are typical smallmouth bass streams.

The alternatives will be analyzed to quantify changes in parameters that affect stream water quality and habitat including road miles, stream crossings, riparian health, and silvicultural practices. To assess the condition of streams, a community approach using an Index of Biotic Integrity (IBI) for fish and macroinvertebrates will be used in conjunction with smallmouth bass population information.

Currently, the biggest concerns for aquatic stream habitats in the Forests are sedimentation, future sources of large woody debris for self-maintaining diverse habitat components, canopy cover to maintain water temperature regimes, and impacts from roads. Ground disturbing management activities in watersheds, particularly in the riparian areas, have the most potential for effects on fisheries and aquatic habitat resources on the Forests. Other threats include the removal of large trees that are located close to aquatic systems. These large trees provide shade,

components in the continuous replacement of large woody debris to stream channels. Large logs and stumps create diverse habitat niches in streams vital to aquatic organisms and allow for streambed stability.

Timber harvesting can directly affect sediment transport in streams if it increases (or decreases) the supply of sediment, if it alters the peak flow or the frequency of high flows, and if it changes the structure of the channel by removing the supply of large woody debris that forms sediment storage sites. Bank erosion and lateral channel migration also contribute sediments if protective vegetation and living root systems are removed.

Roads affect the timing and volume of stream discharges by: intercepting and concentrating surface and subsurface flows; expanding or decreasing the channel networks; and reducing infiltration. The historic hydrological patterns within a watershed may be altered affecting the functions and processes to which the riparian and its inclusive aquatic communities have adapted. Roads located within the riparian corridor that either parallel or cross a stream present the greatest potential for allowing pollutants into surface waters. The road crossings also present a potential barrier to fish movement (including smallmouth bass) that can potentially fragment populations and cause genetic segregation.

Migration and movement of aquatic species are primarily restricted at road crossings by jump, velocity, depth, behavioral, or any combination of these four barriers. Migration and movement barriers may be desirable (in rare cases) to protect a native species from a non-native competitor. During watershed level analysis, the aquatic communities should be sampled above and below any culverts that could be barriers. When the aquatic community above a culvert appears to have lost components, a decision should be made to either restock the unoccupied habitat through seining, electro-fishing, or replacing the culvert to facilitate natural movement back into the area. In some cases, genetics studies should be done on specimens from the same species above and below the road crossing to determine if genetic fragmentation of the population is occurring.

Cobble substrate with interstitial spaces is an important habitat component for young smallmouth bass found in streams on the Ozark NF (Walters 1993). Sedimentation from roads and timber harvest can lead to higher amounts of smaller particle size in the streambed and filling of the interstitial spaces. In the same study on the Buffalo River, adult smallmouth bass were found to need large wood and snags as an important habitat component in the use of microhabitats (Walters 1993; Edwards et al. 1983). Timber harvests as well as other management activities can decrease the influx of large woody debris to the stream system, which can greatly decrease the amount of this resource available as habitat for the smallmouth bass. All age classes of smallmouth prefer protection from light (Edwards et al. 1983) and optimal water temperatures (Arkansas–20ºC to 26ºC) (Bowman 1993). Riparian areas with thick canopies stretching across the stream can control the penetration of light and regulate stream temperatures. Smallmouth bass can also be found in lakes and reservoirs where the limiting factors are temperature (20ºC to 26ºC), dissolved oxygen (optimal above 6.0 parts per million [ppm]; good production above 4.0 ppm),

and low amounts of nutrient enrichment. These factors can be controlled by the Forests by maintaining a forested watershed draining into these lakes, establishing healthy riparian systems around the feeder streams and rivers, and controlling the aquatic vegetation in the water body.

Aquatic habitats are included in the Riparian Corridor Prescription and do not vary by alternative except for Alternative A, which represents the current Forest Plan. In the current plan no specific prescription was given for riparian corridors but streamside management zones (100-ft. wide on each stream bank) were protected. Under the new prescription, riparian areas and aquatic resources are managed to retain, restore, and/or enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within the corridor. Riparian habitats and fisheries are sustained in a healthy condition. Vegetation management occurs only when needed to protect or enhance riparian dependent resources. A slow progression toward a mature forest of more shade tolerant species occurs. More large woody debris is deposited into streams. Current fish management practices such as stocking, streambank stabilization, and use of habitat improvement structures may be suitable.

The Riparian Corridors Prescription Management Area (3.I) designates riparian corridors for perennial streams, natural ponds, and lakeshores. In the standards and guidelines section of the plan, standards and guidelines are also set to protect intermittent and ephemeral streams during forest management practices. The riparian corridor will be managed to retain, restore, and/or enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components within the corridor in all alternatives. These standards and guidelines may have a beneficial effect on the communities and their associated species.

Direct and Indirect Effects

Table 2-14 (Page 2-26) gives the expected trends in smallmouth bass populations over the five alternatives. There were no differences observed in sediment increases between alternatives ("Water Resources Section"). All the alternatives except for Alternative A contain management prescriptions for riparian areas. Standards and guidelines are the same for all alternatives. Given this information, Alternative A is the least acceptable alternative from a smallmouth bass standpoint and Alternatives B, C, D, and E are the most acceptable alternatives.

Cumulative Effects

When the effects of the management from any of the alternatives of the Revised Plan are combined with potential effects of all other planned or anticipated projects on both public and private lands, there will be no known cumulative effect to smallmouth bass. All the alternatives should keep smallmouth bass populations at current levels or increase the populations of this species.

With the Revised Forest Plan, forest personnel will utilize a monitoring technique using IBI and trends in relative abundance to monitor aquatic communities.

Largemouth Bass

Affected Environment

Largemouth bass was selected due to popularity as a sport fish and as an indicator of high quality pond and lake habitat. Recent monitoring has documented mixed results for this species.

Alternatives will be analyzed to quantify changes in parameters that affect pond and lake water quality and habitat including sedimentation and management of the riparian zone around the lakes and ponds. Lake and pond fish communities will be analyzed to determine trends in fish community structures. This information will be useful to determine overall habitat condition of lakes and ponds. Acres of lake habitat improvement will also be tracked.

Currently, the biggest concerns for aquatic lake and pond habitats in the Forests are sedimentation, water quality, habitat availability, riparian health, and fishing pressure. Ground disturbing management activities in watersheds, particularly in the riparian areas, have the most potential for effects on fisheries and aquatic habitat resources on the Forests. Largemouth can also be effected by the same factors as smallmouth bass when found in stream and river systems.

Land-water interactions change and control the physical and chemical characteristics of ponds and lakes. Lake habitat management cannot be understood unless one has an understanding of watershed conditions draining into this body of water. In the long term, sediment and nutrient problems must be controlled at their source rather than trying to handle the problem after it enters the body of water.

Timber harvesting can directly affect sediment transport in streams if it increases the supply of sediment, if it alters the peak flow or the frequency of high flows, and if it changes the structure of the channel by removing the supply of large woody debris that forms sediment storage sites. This can increase the amount of sediment and nutrient loading the lakes and reservoirs that are fed by the watershed; therefore, increasing the aging process of the water body.

Roads affect the timing and volume of stream discharges by: intercepting and concentrating surface and subsurface flows; expanding or decreasing the channel networks; and reducing infiltration. The historic hydrological patterns within a watershed may be altered affecting the functions and processes to which the riparian and its inclusive aquatic communities have adapted. Roads located within the riparian corridor that either parallel or cross a stream or lakes present the greatest potential for allowing pollutants into surface waters.

Largemouth bass are intolerant of suspended solids and sediment (Stuber et al. 1982; Bowman 1993). The Forests can control this sediment by controlling bank erosion on the feeder streams and sediment inputs from the watershed during management practices like road construction and timber harvest. Riparian buffers can also be important in controlling sediment inputs, as well as, controlling water

temperature, and increasing the amount of large woody debris that migrates into the water body for utilization as fish cover. The Forests can also improve habitat availability by adding fish structures to the lake or reservoir in the form of brush, Christmas trees, cement blocks, and other fish structures (Stuber et al. 1982). Fishing pressure can decrease populations especially during years of poor young-of the-year classes. The Forests can improve these populations by supplemental stocking, which can increase the population size and sustain a higher rate of harvest (Burnley 1994). The Forests can also work closely with the Arkansas Game and Fish Commission to control fish regulations that can help regulate largemouth bass populations.

Direct and Indirect Effects

Table 2-14 (Page 2-26) gives the expected trends in largemouth bass populations over the five alternatives. There were no differences observed in sediment increases between alternatives (Water Resources Section). All the alternatives except for Alternative A contain management prescriptions for riparian areas. Standards and guidelines are the same for all alternatives. Given this information, Alternatives A is the least acceptable alternative from a largemouth bass standpoint and Alternatives B, C, D, and E are the most acceptable alternatives for largemouth bass.

Cumulative Effects

When the effects of the management from any of the alternatives of the Revised Plan are combined with potential effects of all other planned or anticipated projects on both public and private lands, there will be no known cumulative effect to largemouth bass. All the alternatives should keep largemouth bass populations at current levels or increase the populations of this species.

With the Revised Forest Plan, forest personnel will utilize a monitoring technique using IBI and trends in relative abundance to monitor aquatic communities.

OLD GROWTH

Affected Environment

Management for old growth conditions has been a part of the plans for OSFNFs since 1978. The 1986 LRMP direction was to designate approximately 150,000 acres to be managed for old growth condition by the end of the 10-year plan. Of those 150,000 acres, 85,000 were to come from uneven-aged management prescriptions in Management Area 8. The Plan specified the following characteristics that were key to old growth:

- Two or more tree species with a wide size and age range,
- A deep, multilayered canopy,
- More than 10 live trees over 120 years old or over 22 inches diameter at breast height (dbh) per acre,

- Significant coarse woody debris including more than 10 snags per acre over 20 feet tall, and
- At least 4 snags or logs per acre greater than 22 inches in diameter and 30 feet in length.

Chief Dale Robertson issued a position statement in 1989 regarding old growth forests (Forest Service 1989). In this statement, he clearly defined his view of the agency's definition for old growth forests. The major points of his definition included ecosystems in later stages of development typically different from earlier stages with wide variations in age and structural attributes. He noted that fire-dependent old growth types might not appear significantly different from earlier stages of the same type.

In June 1997, the Southern Regional Forester released 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 gave operational definitions for 16 old growth community types that encompassed nearly all of the forest cover types in the Southeast. A few were considered as rare communities and the tropical forests of the Caribbean were not included. The operational definitions established the following four criteria, which had to be met before a stand would be considered "existing" old growth:

- **Age** - a minimum age in the oldest age class.
- **Past Disturbance** - no obvious human-caused disturbance that conflicts with old growth characteristics.
- **Basal Area** - minimum basal areas of stems 5” dbh and larger.
- **Tree Size** - a minimum dbh of the largest trees.

The report also recommended each forest in the Southern Appalachian Assessment (SAA) and Ozark/Ouachita Highlands Assessment (OOHA) provides a distribution of large (more than 2,500 acres), medium (100 through 2,500 acres), and small (10 through 99 acres) potential old growth patches; and representation of all potential old growth forest community types. The distribution guidance did not specify an amount, such as acres or percents of area. In addition, old growth patches were assumed to be occurring on NF land in a matrix of mid- to late-successional forest conditions, providing connectivity without old growth allocations being physically contiguous. Representation was limited to ensuring that old growth community types were present. No total amount or amount per community was specified. Acres were to be based on public issues and ecological capabilities of the land.

The Biological Significance Of Old Growth

Currently, no species have been identified in the southeastern United States that are considered old growth obligates; that is, requiring old growth for some portion or all of their life cycle. Therefore, the provision of existing or future old growth is not directly linked in a cause-and-effect relationship to the viability of any species. However, old growth is a condition that is particularly rich in habitat attributes for a variety of wildlife. These attributes occur in close association (intra-stand) with one another as opposed to a landscape scale (inter-stand) distribution. A wider variety of

habitat roles are available than in earlier life stages of the same community. In more mesic communities, the long development period with low disturbance is conducive to the formation of multiple canopy layers that may include emergent trees, dominant and co-dominant trees, suppressed trees, and a forest floor shrub or shade-tolerant herbaceous layer. Canopy gaps of various sizes caused by:

- The death in-place of a single tree,
- The deaths in-place of small groups of trees, or
- The falling of a group of trees, in comparison with their immediate surroundings provide micro-sites with higher light regimes, higher stem counts, and an "edge effect" both around the edge of the gap and back into the surrounding stand.

Standing dead trees provide large and small diameter snags for foraging, perching, and cavity excavation. Down logs and limbs provide a substrate for wood-decomposing fungi and insects; cover for small mammals, amphibians, and insects. Large-diameter living trees, with a long-term exposure to natural damaging agents, have the potential through wood-rotting fungi activity for the formation of large cavities suitable for bear, raccoon, squirrel, bats, or other cavity users. The heavy limb structure that develops in some tree species as they age provides sturdy nest platforms for species such as bald eagles. Mesic communities are limited in distribution on the OSFNFs.

Most upland communities on OSFNFs are fire-dependent communities that are dominated by single-aged or two-aged stands of trees. Frequent fire helps perpetuate the pine and oak dominated community types and helps retard development of fire-intolerant and shade-tolerant woody and herbaceous vegetation. Development of a diverse fire-tolerant herbaceous and shrub layer is characteristic of these stands. These communities are quite diverse and have pockets or imbedded areas that burn less frequently and with less intensity. This provides for fire-intolerant communities on a more limited scale. Fire has played a role in limiting stand densities, which is also an important characteristic of old growth stands in these communities.

The Social Significance of Old Growth

Whether biologically necessary to species or not, old growth is of value. As with wilderness, there also appears to be an "existence value" for places almost completely unmodified by humans whether or not those holding such values ever visit them. There can often be a historical, cultural, or spiritual value associated with old growth. There also is value in providing old growth on a landscape scale to which each person holding that value can readily relate. In other words, it is not enough to say something valued is being provided "somewhere."

Old growth has other recognized social values. It is a desirable recreation setting, both for its biological variety and for the associated state of mind from knowing one is in an "old growth" setting. It serves as a "biological time machine" in that it is a reference area for what ecologically comparable areas may have been previously and can be restored to given a similar amount of time and disturbance history. They are a

valuable part of showing a comprehensive "whole" of ecological dynamics in conservation education. Old growth areas are a source of scientific information (e.g., tree ring analysis).

The analysis of old growth begins with identifying the old growth communities that are appropriate to each national forest. The OSFNFs have eight of the sixteen old growth forest communities, which are identified in the Old Growth Report. In 2003, updated communities were released for the Ozark Physiographic Region.

Table 3-74 shows the old growth types by community for the OSFNFs. For some of the old growth types, the provision of large blocks is not feasible because the Forest Service does not administer enough lands ecologically appropriate for that type.

Table 3-74: Acreage of Major Forest Communities on the OSFNFs.

Community Name	Acres
Dry Oak Forest and Woodland	351,000
Shortleaf Pine-Oak Forest and Woodland	291,000
Dry-Mesic Oak Forest	436,000
Mesic Hardwood Forest	7,000
Riparian Forest	2,900
Loblolly Pine Forest	13,229
Community Name	**Acres**
Loess Slope Forest	16,200
Bottomland and Floodplain Forest	2,500
Loblolly Pine Forest	137

***This is not a native community. These acres will be assigned to another community at the time of stand replacement. (Source: OSFNFs GIS database.)**

The Old Growth Report recognizes the following three categories of old growth for forest planning: existing old growth, possible old growth, and future old growth.

Existing Old Growth is defined in the Old Growth Report as forest stands that meet all four criteria (age, disturbance, basal area, and tree size) described in the operational definitions.

Current vegetation inventory data for the OSFNFs are not sufficient to determine whether or not all four of these criteria are satisfied. The amount of existing old growth meeting the four criteria is not currently known.

Possible Old Growth consists of forest stands that meet one or more of the old growth requirements. Table 3-75 details the total acres of old growth community types on the forests, the acres that meet the minimum age requirement for the various old growth community types, and the percentage of possible old growth in each community type. The stands need to be evaluated during plan implementation to determine if they meet the other three old growth requirements and if they are appropriate for management as old growth.

Table 3-75: Current Acres of Possible Old Growth by Major Community Types - OSFNFs.

Old Growth Community Type	Total Acres	Age to Qualify as Old Growth	Possible Old Growth Acres (Current)	Percent in Possible Old Growth (Current)
Dry Oak Forest Woodland	351,000	110	250	0.1
Dry-Mesic Oak Forest	436,000	110	0	0
Mesic Hardwood	7,000	140	0	0
Shortleaf Pine- Oak Forest and Woodland	291,000	110	10,793	3.5
Ozark-Ouachita Riparian	2,900	100	0	0
Loess Slope Forest	16,200	140	0	0
Bottomland and Floodplain	2,500	110	0	0
Loblolly Pine Forest*	13,229	NA	NA	NA
Total	1,119,829		11,043	

***This is not a native community. These acres will be assigned to another community at the time of stand replacement. Source: Forest CISC Data.**

Future Old Growth is defined as stands or patches allocated to old growth through land management decisions although they do not meet one or more of the old growth criteria in the operational definitions. Presently, these patches contain little if any existing old growth.

Each alternative evaluated includes management prescriptions that indirectly provide future old growth as the result of management focused on other values such as pine-bluestem restoration and restoration of oak savanna/woodland. Riparian areas and unsuitable lands within suitable management prescriptions are included in future old growth. The primary focus of old growth management in the short-term is restoring it on the landscape. The primary (but not the only) components of restoration are simply time for existing stands to age and reduction of basal areas. For that reason, alternatives are compared by the acreage they allocate to future old growth conditions.

Some lands will require project level examination to determine if they are appropriate for old growth compatible management. Wilderness and proposed wilderness would reach the age requirements for old growth, but would only qualify on the few acres that are in ecological types that are very mesic and that historically did not evolve with fire playing a major role.

Direct and Indirect Effects

Potential old growth will occur in forest communities when they have reached the proper age for that community (see Table 3-75). Table 3-76 shows the amount of this older timber by community type 10 years and 50 years into the Plan. The table demonstrates that old forest conditions increase in all alternatives. All communities have an increase in acres of potential old growth at ten years. After fifty years of implementation, all alternatives show that potential old growth is common in all communities.

For additional effects, see the old growth discussion for each community in the "Major Forest Communities" section (Page 3-97).

Table 3-76: Acres of Possible Old Growth by Major Community Types for Each Alternative after 10 Years/50 Years.

Old Growth Community Type	Total Acres Current	Alternatives				
		A	B	C	D	E
		Total Acres After 10 years				
Dry Oak Woodland	250	668	638	668	668	668
Dry-Mesic Oak Forest	0	0	0	0	0	0
Mesic Hardwood	0	920	924	1,036	1,040	1,029
Shortleaf Pine-Oak Forest & Woodland	10,793	21,625	25,348	25,179	23,847	22,251
Ozark-Ouachita Riparian	0	458	461	517	519	514
Loess Slope Forest	0	324	325	365	366	362
Bottomland & Floodplain Forest	0	836	840	942	945	936
Total	11,043	24,831	28,536	28,707	27,385	25,760
		Total Acres After 50 Years				
Dry Oak Woodland	250	224,562	229,874	225,207	219,278	233499
Dry-Mesic Oak Forest	0	298,895	305,973	298,630	290,252	309,517
Mesic Hardwood	0	3,998	4,100	4,694	4,628	4,762
Shortleaf Pine-Oak Forest & Woodland	10,793	73,718	80,891	93,071	50,281	90,118
Ozark-Ouachita Riparian	0	817	932	1,228	1,238	1,257
Loess Slope Forest	0	11,257	11,453	11,444	11,137	11,796
Bottomland & Floodplain Forest	0	932	981	1,580	1,599	1,553
Total	11,043	614,179	634,204	635,854	578,413	652,502

Implementing guidelines in the following management areas should create future old growth and lands having characteristics of old growth. This includes fire frequencies needed to qualify for old growth (See Table 3-79 for management area acres):

- 2.E Wedington Unit Urban Recreation Area
- 3.A Pine Woodland
- 3.B Oak Woodland
- 3.C Mixed Forest

- 3.F Old Growth Area
- 3.K Wildlife Emphasis Area

As can be seen in Table 3-77, Alternatives A, C, and E contain large acreages in management areas that would tend to produce old growth conditions. Alternatives B and D have few acres in these management areas.

Table 3-77: Acres by Alternative of Old Growth in MAs that Tend to Produce Old Growth.

Management Area	Acres by Alternative				
	A	B	C	D	E
2.E-Wedington Unit Urban Recreation Area	0	10,467	0	0	10,467
3.A-Pine Woodland	22,570	0	98,196	0	97,629
3.B-Oak Woodland	30,858	0	168,926	0	154,704
3.C-Mixed Forest	945,543	0	598,422	0	360,401
3.F-Old Growth Areas	0	0	5,062	5,062	5,062
3.K-Wildlife Emphasis Area	0	15,712	0	0	15,712
Total	998,971	26,179	870,606	5,062	643,975

The following management areas provide for partial old growth characteristics. Fire frequencies may not be adequate to qualify for old growth (See Table 3-80 for management area acres):

- 0.A Custodial Management
- 1.A Designated Wilderness
- 1.B Recommended Wilderness Additions
- 1.C Designated Wild and Scenic Rivers
- 1.D Recommended Wild and Scenic Rivers
- 1.F Research Natural Areas
- 1.G Special Interest Areas

As seen in Table 3-78, Alternative B places large acreages in custodial management. This would produce old timber but would reduce the acres available for treatments needed to produce old growth conditions. All other alternatives would produce similar smaller amounts in the areas that tend to be more restrictive to active vegetation management.

Table 3-78: Acres by Alternative of Old Growth in MAs that Provide for Partial Old Growth.

Management Areas	Acres by Alternative				
	A	B	C	D	E
0.A-Custodial Management		518,791			
1.A-Designated Wilderness	66,728	66,728	66,728	66,728	66,728
1.B-Recommended Wilderness Additions	0	0	471	0	471
1.C-Designated Wild and Scenic Rivers	19,859	19,859	19,859	19,859	19,859
1.D-Recommended Wild and Scenic Rivers		6,219	6,219		6,219
1.F-Research Natural Areas	2,682	2,682	2,682	2,682	2,682
1.G-Special Interest Areas	22,311	22,311	23,243	22,311	23,243
Total	111,580	636,590	119,202	111,580	119,202

Cumulative Effect

All alternatives provide increasing amounts of lands with old growth characteristics. Acres of old growth conditions on private lands are currently increasing at a slower rate than those on national forests throughout the Ozark Region. Use of fire on private forestlands is rare and not expected to increase significantly. Old growth conditions on national forest and park service lands are expected to comprise the bulk of lands with old growth conditions for the foreseeable future.

It is hard to predict what will happen on private lands surrounding the national forests. Market values for timber products will probably dictate the amount of old growth condition on lands surrounding OSFNFs. Buffalo National River lands are expected to contain some large, medium, and small patches of old growth condition in the future providing a corridor between the Buffalo Ranger District and the Sylamore Ranger District.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES (TES)

Affected Environment

The following section describes existing conditions and potential effects by alternative for all TES known to occur or having the potential to occur on the OSFNFs. Currently, there are 19 federally listed endangered and threatened species found on or near the Forests. In addition, 31 sensitive species are addressed. Table 3-79 shows the totals of these endangered, threatened, and sensitive species. See Appendix E for a complete list of the current Threatened, Endangered, and Sensitive Species associated with the OSFNFs.

Table 3-79: Threatened, Endangered, and Sensitive Species on the OSFNFs.

Group	Endangered	Threatened	Sensitive	Total
Vascular Plants	2	1	21	24
Snails	0	1	0	1
Mussels	3	0	1	4
Insect/Isopod	1	0	2	3
Crayfish	2	0	1	3
Fish	1	1	3	5
Reptile/Amphibian	0	1	1	2
Birds	2	1	1	4
Mammals	3	0	1	4
Total	14	5	31	50

Analyses include Environmental Baseline, Potential Effects, Cumulative Effects, and Determination of Effect.

VASCULAR PLANTS

Missouri Bladderpod (*Lesquerella filiformis*) - Endangered

Affected Environment

This plant is known from the limestone glades of the Springfield Plateau area of southwestern Missouri and from parts of Arkansas. Most often, it is found on highway rights-of-way and pastures where mowing and grazing have kept the area open. Occasionally, it is found in open rocky woods. The species is currently known from about 60 sites (in 1987, when the species was listed endangered, only nine sites were known). Further inventories may continue to uncover additional populations. The population size has fluctuated greatly, but may have reached half a million in the most favorable years.

The decline of this species is attributed to several factors including lose of habitat in open glades through encroachment of woody vegetation, exotic cool season grasses, and/or exotic species. In addition, the following have affected habitat for this species:

- Urbanization/Urban development
- Conversion of native landscapes to exotic pasture grasses
- Trampling (foot, vehicle, etc…)
- Over-grazing
- Off-highway vehicle use
- Highway maintenance activities along rights-of-way, including mowing and herbicide
- Limestone quarrying

Missouri bladderpod benefits from proper glade management (including prescribed fire), and will tolerate some grazing. Historically, natural disturbances such as fire kept the glades open and free of trees and shrubs. Prevention of wild fires and

aggressive control have introduced grasses and allowed woody plants to invade glades. Since the Missouri bladderpod can only grow in open areas, it cannot compete with these plants. When overgrown with these species, it will die out.

In Arkansas, this species is found in Izard and Washington Counties, but not on FS lands. However, suitable habitat is found on the Sylamore Ranger District and on the Wedington Unit of the Boston Mountain Ranger District. Surveys conducted in the past have failed to note the presence of this species anywhere on the Forests.

Direct and Indirect Effects

Treatments such as prescribed burning, native grass establishment, and timber harvest treatments that remove the woody species competition in glade habitat, will be beneficial. Following forest-wide standards for herbicide application, which provide a 60-foot buffer, would result in no negative impacts to this species from herbicide use. Since this species does not occur on or near the Forests, there will be no direct or indirect effects on this plant.

Cumulative Effects

Continued urbanization and conversion of native landscapes to exotic pasture grasses will continue on private lands. In addition, trampling, over-grazing, and off-highway vehicle (OHV) use will continue to adversely affect this species on private lands. Forest Service management will encourage the development of habitat needed for this plant despite the fact that it is not known to occur on the Forests. Therefore, when the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Pondberry (*Lindera melissifolia*) - Endangered

Affected Environment

The habitat for pondberry is described as seasonally flooded wetlands (such as floodplain hardwood forests and forested swales) and in coastal areas (of the Carolinas) along the margins of sinks, ponds, and depressions in pinelands.

This plant exists at about 36 sites across the southeastern United States. Although a few existing populations appear quite large, many of the plants may be clones rather than different genetic individuals. It is believed that the species has been exterminated from three states (Alabama, Florida, and Louisiana) in its historic nine-state range.

The decline of this species is attributed to several factors including the following:

- Loss and degradation of suitable habitat (ANHC 2002),
- Loss of habitat due to draining wetlands for agriculture or pine plantations,
- Conversion of the majority of its habitat to agricultural field,
- Timber practices of cutting and certain harvesting methods,
- Draining and flooding of wetlands, and
- Limitation of reproduction in the wild (many colonies are exclusively male).

It has been reported in seven Arkansas counties, but has not been found on the Forests or in any counties that have NF lands. Seasonally flooded bottomland hardwood habitat, which is required for this species, is very limited with likely less than 300 acres on the St. Francis NF found in Management Area 3.H.

Direct and Indirect Effects

Management activities proposed with each alternative along with applicable forest-wide standards will reduce or eliminate potential negative impacts of activities on potential habitat found on the forests. Since habitat needed for this species is protected, and because associated wetlands will receive similar protection, there would be no direct or indirect effects on this endangered plant species.

Cumulative Effects

When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Geocarpon (*Geocarpon minimum*) - Threatened

Affected Environment

Geocarpon prefers eroded areas in grasslands called "slicks" or "slickspots". Bare soil over sandstone, slicks are high in salinity and may be the remains of ancient Pleistocene lakebeds. It is unknown if these slicks are renewed by fire or flooding, or if they eventually disappear. If they are renewed, geocarpon may be a pioneer species or one of the first plants to take root in a newly cleared habitat.

This species has been found in four Arkansas counties: Bradley, Cleveland, Drew, and Franklin Counties. It appears to be confined to south Arkansas except for one site in Franklin County, which is south of the Arkansas River and not close to NF land. As mentioned above, habitat for this species is not known to exist on the OSFNFs.

Vegetational succession appears to be the major threat to this tiny, inconspicuous plant. When grasses or shrubs encroach on a slick, the plant fails to complete. If slicks do result from fire, then fire suppression would hasten encroachment of geocarpon habitat.

Direct and Indirect Effects

Neither this species nor its habitat is known to occur on the OSFNFs. Implementation of any alternative would have no direct effect on this plant. Treatments such as timber harvest and prescribed burning that tend to open the forest canopy and reduce brushy competition would likely be beneficial to this species. Actions proposed with each alternative would have no impact on off-forest sites. There would be no indirect effects on this plant.

Cumulative Effects

Since there are no known sites on the Forest, or suitable habitat, activities addressed here would have no cumulative impacts on this species. If plant locations are found later, sites would be protected by implementation of forest wide standards or policy. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Ouachita False Indigo (*Amorpha ouachitensis*) - Regional Forester's Sensitive

Affected Environment

The usual habitat for the Ouachita leadplant seems to be on rocky, open, and sunlit areas having reliable soil moisture. It occurs on glades, roadside banks, in roadside ditches, and along ephemeral drainages. Further south into the Ouachita Mountains, this species appears to prefer the edges of small streams and drainages.

This plant is known from several locations on Mt. Magazine (Tucker, 1989). This endemic is found elsewhere in Arkansas and Oklahoma. It has been noted in Conway, Franklin, Johnson, Logan, Madison, and Van Buren Counties as well as in southern Arkansas in Clark, Garland, Montgomery, Perry, Polk, Saline, Scott, and Yell Counties.

This species could be affected by increased foot traffic, herbicide use along trails/ roadside areas, or by construction activities that include the scraping or clearing of land by bulldozer.

Habitat on the Forests is limited to streamside zones and a few roadside ditches where ground disturbance has occurred.

Direct and Indirect Effects

The primary threat to the Ouachita leadplant throughout its range is habitat destruction by land clearing, trampling by foot traffic, and herbicide use along roadsides where it occurs. Forest-wide standards for the riparian sites as well as streamside management zones will help protect many of the sites known on the Forests.

Following the implementation of forest wide standards for herbicide application, there would be no direct or indirect impacts on this sensitive plant. Herbicide application will not occur within 60 feet of plant locations.

This species seems to prefer more open canopy conditions and does not tolerate much brush species competition. Treatments like thinning and prescribed burning will likely improve habitat for this species. Ground disturbing activities such as road, pond, or wildlife opening construction may impact individuals but is not likely to cause a trend to federal listing or a loss of viability.

Cumulative Effects

Because populations of this species are distributed across the western and southern portion of the Forests and most are in areas that will receive protection with the implementation of forest-wide standards or are in areas where little or no management would occur, there would be no impact to most sites. Those sites where timber-harvest treatments occur or where prescribed burning occurs will benefit from those actions. Negative impacts are expected with road construction and other ground disturbing activities although that is a very small level of disturbance when compared to the range of the species and the number of known sites, which will not be adversely impacted.

When the impacts of any alternative addressed in this document are combined with potential impacts of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Bush's Poppymallow (*Callirhoe bushi*) -Regional Forester's Sensitive

Affected Environment

The usual habitat for this plant is rocky open woods, wooded valleys, ravine bottoms, and borders of glades. This plant ranges from extreme southwestern Missouri to northwest Arkansas and northeastern Oklahoma. In Arkansas, it has been noted in Benton, Boone, Carroll, Conway, Logan, Marion, Searcy, and Washington, Counties.

This species has often been noted in Benton and Washington Counties on roadsides and is easily viewed from several county roads. This species is known from several locations on the Wedington Unit of the Boston Mountain Ranger District.

Threats to this species include collection by plant enthusiasts and herbicide application along roadside areas where it occurs.

Direct and Indirect Effects

Timber management glade management, and prescribed burning would improve habitat for this species by opening the forest canopy and promoting the growth of early seral plant communities, which would have a beneficial impact on available habitat for this species.

Reestablishment of native grass species and the reduction of non-native grass species in openings and fields will increase the number of available acres where this species could occur. Herbicide application along roadsides where it now occurs could impact individuals but most sites have been treated in the past and although the populations there are set back by the application, they usually bounce back quickly following treatment. Herbicide treatments could impact individuals but are not likely to cause a trend to federal listing or a loss of viability.

Collection by the public along easily accessed roads will likely continue. Road closures on parts of the Forests have likely helped to reduce this problem but they will persist.

Cumulative Effects

Because this plant is found scattered on numerous sites over northwest Arkansas and southern Missouri, it is unlikely that actions addressed here would impact this species significantly. The greatest threat to this species is collection and that is typically done along roadsides on both public and private lands. The Forest Service has already closed many roads to OHV use on the Wedington Unit. This species would have improved habitat conditions with any alternative addressed here.

When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Ozark Chinquapin (*Castanea pumila var. ozarkensis*) - Regional Forester's Sensitive

Affected Environment

Until the introduction into this country of the chestnut blight (*Endothia parasitica*) and its subsequent spread, the Ozark chinquapin had been considered a locally abundant and widespread tree species in the Interior Highland Region. As a result of the spread of this parasite, few mature trees of this species still exist although sprouting from stumps is quite common (Tucker, 1980).

This plant is fairly common and is found on all forest districts except the St. Francis.

The chestnut blight is the dominant threat, making all others insignificant. Other threats include intensive timber harvest activities that serve to disrupt the roots or root crowns (thereby, impacting sprout regeneration), herbicide use, forest clearing for pastureland and other agricultural purposes, pond and road construction, and recreational development. Loss of the natural fire regime has led to successional change that has negatively affected regeneration and growth.

Direct and Indirect Effects

Field observations indicate that Ozark chinquapin, despite its infection with chestnut blight, can be expected to hold its own in competition with other tree species in almost all kinds of disturbance factors resulting from normal forest management practices (Tucker 1989).

The impact to sprout clumps incidental to normal timber management practices or in prescribed burning would be one of release. Since sprouts persist and are released in normal timber management operations, there would be no negative direct impacts to Ozark chinquapin. The indirect impact of normal forest management operations is to perpetuate chinquapin sprout clumps in vigorous vegetative state.

Following the implementation of forest wide-standards for herbicide application, there would be no direct or indirect impacts on this sensitive plant. Herbicide application will not occur within 60 feet of plant locations.

Construction of wildlife openings and roads would impact individual plants but because the population is so large and wide spread; it would impact individuals but is not likely to cause a trend to federal listing or a loss of viability.

Cumulative Effects

This species is likely to hold its own despite its infection with chestnut blight, which is the biggest threat to this species. Activities addressed here may impact individuals but will not lead to federal listing or a loss of viability. Because there are so many populations scattered over a relatively large area, actions addressed here would likely have a positive impact on this species.

Southern Lady's Slipper (*Cypripedium kentuckiense*) - Regional Forester's Sensitive

Affected Environment

Habitat for this plant consists of moist floodplains along creeks and on rich, moist slopes. It is a large plant, can grow to a height of three feet, and has a pale, deep lip that barely extends past its opening. The collection for commercial sale and the digging for replanting in wildflower gardens pose the biggest threat to the plant. The plant appears to be able to tolerate certain timber management activities with some treatments, such as thinning, beneficial

This species is known to occur in 12 Arkansas counties and possibly others (Smith, 1988). Southern lady's slipper occurs in a relatively narrow range from northeastern Texas and southeastern Oklahoma east to Georgia (although very few sightings) and north to Kentucky. There are very few, if any, protected sites. Threats include highway construction and possible exploitation through plant collecting.

This species is found in the western one-third of the Forests and is confined to riparian areas, moist floodplains, or rich moist slopes.

Direct and Indirect Effects

If the plant were actively growing at the time of disturbance, timber harvest would have a direct adverse impact on species by top killing the plant by trampling. Summer burning would directly impact this species by top killing the plant. Certain silvicultural practices that open the forest floor to more sunlight (drying the site) could have an indirect adverse impact on habitat. Cool season prescribed burning would likely not impact this species since above ground vegetation would have already died back over winter. This plant typically occurs in more mesic habitats. Fires here usually occur with less intensity, and do not burn as much of the leaf litter as on drier sites. Forest-wide standards provide a protective buffer along streamside management zones and in riparian areas and indirectly protect habitat for this species.

Following the implementation of forest-wide standards for herbicide application, there would be no direct or indirect impacts on this sensitive plant. Herbicide application will not occur within 60 feet of sensitive plant locations following forest-wide standards for the protection of this sensitive species.

Road, pond, or wildlife opening construction could adversely impact this species if it were present.

Collection by the public along easily accessed roads will likely continue. Road closures on parts of the Forests have likely helped to reduce this problem, but they will persist.

Cumulative Effects

Because this plant is found scattered over a large geographical area with several sites found on the western portion of the Ozarks as well as in the Ouachita Mountains, it is unlikely that actions addressed here would impact this species greatly. The greatest threat to this species is likely from collection on both public and private lands. The Forest Service has already closed many roads to OHV use, but additional closures may be necessary.

When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Moore's Delphinium (*Delphinium newtonianum*) - Regional Forester's Sensitive

Affected Environment

Moore's delphinium is endemic to and locally abundant in two disjunct regions of the Interior Highlands regions of Arkansas, but it is unknown from either Missouri or

Oklahoma. Preliminary biological data indicates it is of widespread occurrence within a relatively small area in the Ozark National Forest, where it occurs in both mature and successional vegetation types. Moore's delphinium "prefers light to heavy shade of hardwoods, a moist loamy clay or sandy clay loam" (Kral, 1983). It also occurs on sites having at least some pine in the overstory and along roads, trails, and openings in forested areas (Tucker, 1990).

This species has been reported in five Ozark counties (Johnson, Newton, Pope, Searcy, and Van Buren) and two Ouachita counties (Montgomery and Pike) (Smith 1989).

Most of the sites on both private and federal lands are within the normal operating limits of common land management activities, including timber management activities.

Certain types of timber management and timber harvest activities have a potential to represent threats to maintaining species viability in Moore's delphinium. Practices that result in elimination of Moore’s delphinium plants include total canopy removal or retention of only a small portion of the existing canopy. Activities that result in major ground disturbing activities at deeper soil levels, such as stump removal and bulldozer activity also have a potential for impacts to the species. Prescribed fire has a potential to damage populations, depending on the intensity of the burn. Any burn that is hot enough to remove large amounts of organic surface layers and/or excessively dry the soils has a potential to adversely impact the species. However, it is doubtful that ground fires of very low intensity are detrimental to the viability of this species viability.

Direct and Indirect Effects

At most locations, Moore's delphinium grows within forest communities that have been managed for timber harvest in the past. Some of the largest populations appear to have been high-graded for commercial timber harvest in the past (probably on multiple occasions). The species appears to grow best (i.e., vigorous colonies containing plants of all age groups) on sites that have experienced thinning or canopy alteration through selective harvest. A population on the Ozark NF has been known for many years on a mesic site having extremely heavy shade provided by a forest community of large old trees. Plants have persisted at that site throughout the past 35 years, but the population has been extremely small throughout that period. Observations made at a few additional sites suggest that the species is not as vigorous under excessive shade conditions as on sites having less shade. Timber harvest treatments could impact individuals but is not likely to cause a trend to federal listing or a loss of viability.

Following the implementation of forest-wide standards for herbicide application, there would be no herbicide application within 60 feet of plant locations. There would be no direct impacts on this plant species from herbicide application. Opening the forest floor to sunlight may indirectly impact habitat by drying out sites.

Road and trail construction removes potential habitat for the species. In that sense, this activity has a potential to adversely impact Moore's delphinium. The resulting edge effect from these openings, however, in many cases probably promotes reproduction and localized population expansion, at least in the short term.

Livestock grazing is not likely to impact this species because this plant contains one or more poisonous alkaloid compounds that are known to be toxic to domestic livestock.

Field observations have shown that Moore's delphinium can tolerate at least light fire during the cool season. Because it typically occurs in mesic habitats, there is probably little potential for fire to pass through suitable habitat with more than low to moderate intensity. These mesic sites are naturally buffered from fire impacts except in extreme circumstances where the fire removes large amounts of surface organic material or excessively dries out the surface soils.

Cumulative Effects

Because known forest populations and their habitat are confined to two relatively large areas and other sites are known in the state, impacts of activities addressed in this document would be minimal. Sites on the Forests receive protection not afforded similar sites off-forest. When the impacts of any alternative addressed in this document are combined with potential impacts of all other planned or anticipated projects on both public and private lands, there would be no known cumulative impacts on this species.

Glade Larkspur (*Delphinium treleasei*) - Regional Forester's Sensitive

Affected Environment

According to Smith (1989), this species is endemic to southwestern Missouri and northwest Arkansas. It occurs on limestone glades and bald knobs in the White River region and on rocky open limestone exposures and glades elsewhere.

This plant is known to occur only in Missouri and in counties in north and northwest Arkansas and is relatively common within its limited range, having approximately 80 occurrences. It is no longer tracked in Missouri.

Population trends are largely unknown since only recently have significant inventories been taken. If the current trend is not changed, however, continued habitat loss and degradation will likely lead to continued long-term declines in the species. Many of the remaining populations are small, perhaps an indication of the reduction in high quality, large-sized habitats.

Loss of the natural fire regime and proliferation/encroachment of eastern red cedar (*Juniperus virginiana*) and other woody plants have become a severe threat to glade larkspur habitat. Development of habitat by humans for home building or other uses is a threat to glade larkspur throughout its range. Herbicide application is a threat to

extant populations, particularly those occurring along roadsides and railroad rights-of-way. Insecticide application may be detrimental to the pollinator populations located in proximity to the site.

Direct and Indirect Effects

Habitat for this species would likely benefit from most timber harvest treatments and prescribed burning. Plan direction to restore rare communities including glades should have a direct benefit on habitat for this species.

Following the implementation of forest-wide standards for herbicide application, there would be no herbicide application within 60 feet of plant locations. There would be no direct impacts on this plant species from herbicide application. Opening the forest floor to sunlight may improve habitat for this species, which prefers more open and dry sites.

Activities such as road, pond, or wildlife opening construction would reduce the amount of available habitat for this species slightly. These activities associated with each alternative could impact individual plants but are not likely to cause a trend to federal listing or a loss of viability.

Cumulative Effects

Because there are many known populations that are scattered over northern Arkansas and southern Missouri, some individuals may be impacted, but treatments proposed with each alternative would improve habitat for this species where those treatments occur. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

French's Shooting Star (*Dodecatheon frenchii*) - Regional Forester's Sensitive

Affected Environment

In Arkansas, French's shooting star is typically found in a distinctive microhabitat. Most often, plants are found in largely linear colonies in shade directly beneath overhanging sandstone ledges that are located near or adjacent to stream channels. These ledges can range in size from those associated with small overhangs to large bluff shelters (or rarely beneath natural bridges). The exposure of the overhangs typically is northern or eastern, and plants typically are exposed to direct sunlight only rarely and for short duration, if ever.

Soils on which the species grow are thin and sandy with extremely low cover value from competing plant species. These soils are well drained but typically are moist to wet during winter and early spring months (the plants' period of active vegetative growth and reproductive activity).

This plant is restricted to an area lying mostly south of the glacial boundary in six Midwestern and Southeastern states: Alabama, Arkansas, Illinois, Indiana, Kentucky, and Missouri. The species also has been reported from Minnesota, Pennsylvania, and Wisconsin, but those reports in each case have been based on misidentifications. In Arkansas, it has been documented from only two Arkansas counties (Cleburne and Newton).

Direct and Indirect Effects

At most locations, French's shooting star grows in microhabitats (i.e., beneath sandstone overhangs) within forest communities that have been managed for timber harvest in the past. Some of the largest populations are located in forested areas that have been high-graded for commercial timber harvest in the past (probably on multiple occasions). Observations made at known sites have demonstrated that the species typically is associated with heavy shade conditions for most of the day. Forest-wide standards limit all disturbance activities above and below bluffs. Talus sites are protected as well.

If herbicide applications were to be made, plants would be protected by the implementation of forest-wide standards for herbicide application, which place a 60-foot buffer around plants. There would be no direct impacts on this plant species from herbicide application.

Road and trail construction removes potential habitat for any species. In that sense, this activity has a potential to adversely impact French's shooting star. It is doubtful, however, that roads would be constructed in the proximity of French's shooting star habitat. However, trail construction could occur close to a population. The resulting edge effect from openings associated with trail construction would have a potential to introduce more light and, subsequently, dry the soils. In addition, trail construction in proximity to populations introduces a potential for picking of stems when in flower, thereby, reducing fruit formation and seed dispersal following maturation. Trail construction in these sites is not proposed in any alternative and there would be no direct impacts on this species from that activity.

Field observations that provide solid information on this species' resistance to fire are lacking. Because it typically occurs in isolated and protected habitats such as beneath bluff shelters, overhangs, and natural bridges where there is little available fuel, there is probably limited potential for fire to pass through suitable habitat with more than low to moderate intensity. Because these sites are naturally buffered from fire effects, the impacts of fire may be insignificant except in extreme circumstances where the fire removes large amounts of surface organic material or excessively dries out the surface soils. Aerial parts of the French's shooting star plant are somewhat fleshy and probably would be easily damaged by fire; its fleshy thickened roots, however, probably can withstand at least light fire with little or no damage during the cool season.

Activities associated with each alternative addressed here may impact individual plants but would not cause a trend to federal listing or a loss of viability.

Cumulative Effects

Impacts of activities addressed in this document would be minimal because known forest populations are confined to relatively small areas, and because sites are naturally protected by bluffs and steep slopes. When the impacts of any activities associated with each alternative in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative impacts on this species.

Open-Ground Draba (*Draba aprica*) - Regional Forester's Sensitive

Affected Environment

Generally, the soil in most places where open-ground draba grows is too thin to support a continuous cover of large trees, and it is exposed to at least partial sun.

According to Smith (1989), this species has been reported in six Arkansas counties (Cleburne, Drew, Faulkner, Montgomery, Polk, and Washington). More recently, it is also reported from Stone County.

Potential habitat would primarily occur on glades and open areas on districts where the species has been found. The approximate forest-wide habitat for this species would be less than 100 acres based on known occurrences and habitat available on the Forests.

Threats to this species are relatively minor with mechanical site preparation for intensive pine plantations, particularly in the Ouachita Mountains. However, most of the sites for open-ground draba in the Interior Highlands are on slopes too steep and rocky for this type of timber production. Thinning or cutting the overstory trees is considered beneficial if done properly (Kral 1983). The only threat from timber harvest is from trampling sites where it occurs.

Direct and Indirect Effects

Habitat for this species would likely benefit from most intermediate timber harvest treatments such as thinning and from prescribed burning, which open the forest canopy and allow more sunlight to the forest floor. Even-aged harvest activities and summer prescribed burning could top kill plants or damage habitat by drying sites.

If herbicide applications were to be made, plants would be protected by implementation of forest-wide standards for herbicide application, which place a 60-foot buffer around plants. There would be no direct impacts on this plant species from herbicide application. Opening the forest floor to sunlight may improve habitat for this species, which prefers more open and dry sites.

Activities such as road construction and pond construction could adversely impact individual plants although the probability of that is remote. Roads and ponds are not

normally constructed on steep slopes and given the fact that very few sites occur on the forests; there is little likelihood of adverse impacts on the species or its habitat.

Cumulative Effects

There are very few known sites on the Forests and, cumulatively, activities associated with each alternative addressed here will have little or no impact on continued existence of this species. When the impacts of any activities associated with each alternative addressed here are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative impacts on this species.

Gulf Pipewort (*Eriocaulon koernickianum*) - Regional Forester's Sensitive

Affected Environment

In the western part of its range (Arkansas, Oklahoma, and Texas), it's found in or near permanently moist to wet seepage areas (particularly upland sandstone glade seeps), bogs, and prairie stream banks. Gulf pipewort is intolerant of shade and is probably an early-successional species (Nature Serve 2002).

This species is reported in Benton, Conway, Franklin, Logan, Johnson, Madison, Pope, and Van Buren Counties in Arkansas.

Field studies indicate gulf pipewort is an early successional and often times long persistent species. The margins of pipewort populations are often shortleaf pine, eastern red cedar, and winged elm, (all are early-successional organisms among the woody plant assemblage). A few sites show evidence of some soil disturbance, such as provided by occasional to frequent vehicle traffic through the edge of the population. The species appears to require full sun for its best development. Development of later seral stages in vegetation development probably shades out the pipewort.

There is limited habitat on the Forests for this rare plant species.

Direct and Indirect Effects

Habitat for this species would likely benefit from glade restoration and most timber harvest treatments and prescribed burning, which open the forest floor to sunlight.

If herbicide applications were to be made, plants would be protected by the implementation of forest-wide standards for herbicide application, which place a 60-foot buffer around plants. There would be no direct impacts on this plant species from herbicide application. Opening the forest floor to sunlight may improve habitat for this species, which prefers more open and dry sites.

During harvest or construction activities or operations, some individual plants may be impacted. Opening the forest floor to sunlight will improve habitat for this species and indirectly impact this plant.

Cumulative Effects

Some individuals may be impacted by implementation of alternatives proposed here, but overall, there would be an improvement to habitat for this species. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Large Witchalder (*Fothergilla major*) - Regional Forester's Sensitive

Affected Environment

Large witchalder occurs in mesic-dry to dry habitats of the uplands: rich mountain woods and its most characteristic habitats are disturbed areas on dry ridges of southeastern highlands. It grows in hill areas, often along streams.

In Arkansas, this species is found only in Searcy County. This plant is rare throughout its range of five southeastern states and is disjunct in Arkansas. This plant has not been found on the Forest.

Threats to this species include housing developments, road construction, trampling by humans, deer browsing, competition from exotic or invasive species, and the lack of infrequent fire causing habitat succession.

Direct and Indirect Effects

Intermediate timber harvest activities and cool season prescribed burning would improve habitat for this species by opening the forest canopy and promoting the growth of early seral plant communities; therefore, having a beneficial impact on habitat availability for this species if it were present. Reestablishment of native species is now Forest Service policy and invasive non-native species could be controlled. Herbicide application in riparian sites or streamside management zones where suitable habitat is found for this species is not allowed with forest-wide standards.

Trampling by the public will likely continue. However, there are no known sites on the Forests. Activities proposed with any alternative would have no direct or indirect impacts on this plant species.

Cumulative Effects

If this plant were on the Forests, forest-wide standards would provide some protection for its habitat. Human population growth and urbanization will continue to be the chief threat to this species. When the effects of any alternative addressed in

this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Butternut (*Juglans cinerea*) - Regional Forester's Sensitive

Affected Environment

Butternut occurs in rich woods along the base of slopes or bluffs, and along streams. This tree flowers April until late May. Bark is gray with smooth ridges.

This species ranges from New Brunswick to North Dakota, south to Georgia and Arkansas. Butternut is found on the Sylamore Ranger District in north central Arkansas, and in most counties along Crowley's Ridge on the St. Francis National Forest. There have been reports from Benton and Marion Counties in northwestern Arkansas. One report of butternut on the Wedington Unit has remained unconfirmed despite numerous surveys attempting to locate it there.

Butternut has experienced a serious decline over the past 25 years over its entire range due in part to the butternut canker, caused by a fungus. The butternut canker is believed to be an introduced disease, and was first isolated in the 1960s. In the north central states there has been a 70 percent reduction in live trees, over a 15- to 20 year period, particularly in regeneration since butternut does not sprout.

Direct and Indirect Effects

Timber harvest activities will follow Forest Service guidelines and policy for management. Butternut will be left uncut unless they are dead or pose a risk to public safety. Intermediate timber treatments in stands containing butternut could be beneficial to this species.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application, which place a 60-foot buffer around plants. There would be no direct impacts on this plant species from herbicide application. Opening the forest floor to sunlight may improve habitat for this species, which prefers more open, dry sites.

A fungus (Butternut canker) causes the greatest threat to this species. Some activities proposed in each alternative such as road construction and wildlife-opening construction could impact individuals but are not likely to cause a trend to federal listing or a loss of viability. Surveys for sensitive species should help locate and lead to protection of any individuals of this species if they are present in proposed road construction, pond, or wildlife food plot sites.

Cumulative Effects

Forest-wide standards and Forest Service policy will provide some protection for this species. The butternut canker is still its greatest threat. Forest Service management

will likely improve or enhance habitat for this species. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Alabama Snow-Wreath (*Neviusia alabamensis*) - Regional Forester's Sensitive

Affected Environment

Most populations are found on steep, rocky, wooded sites; however, this is not always true as one Arkansas population is found on a steep riverbank near the Buffalo River. Although site aspect varies greatly, all populations in Arkansas have similar associate species and are usually located in places that, due to their steepness and rockiness, do not lend themselves to human uses whether it be timber harvest or livestock grazing (Nature Serve, 2001).

This species ranges from Alabama and Georgia to Arkansas where it is reported from six sites in four Arkansas counties (Conway, Faulkner, Newton, and Pope).

Direct and Indirect Effects

The steepness of the terrain at many of the locations combined with the rocky substrate has probably historically protected the occurrences from disturbance due to timber harvest. The complete removal of the forest canopy would drastically alter habitat conditions for snow-wreath. The altered growing conditions could result in increased competition from other plant species and indirectly impact this plant. There could be a direct impact on individual plants but because of limitations of forest-wide standards, which limit harvest and road activities on steep slopes where this plant is found, there is little likelihood that this species would be impacted by this activity.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application around these sites. There would be no direct impacts on this plant species from herbicide application.

Alabama snow-wreath has very thin bark and is reported to be highly susceptible to fire. The locations where this plant is found offer the species some protection from fire because fuels there are light.

Road or trail construction is not likely in plant locations due to topography (steep). However, some disturbance of sites and adverse impacts to individual plants is possible.

Cumulative Effects

Impacts of activities addressed in this document would be minimal because known forest populations are confined to relatively small areas, and sites are naturally protected by bluffs and steep slopes. When the effects of any alternative addressed

in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Maple-Leaf Oak (*Quercus acerifolia*) - Regional Forester's Sensitive

Affected Environment

This small tree species occurs in open woods, ledges and cliff edges, and the rocky edges of plateaus. It is endemic to Mt. Magazine and the Ouachita Mountains in Arkansas with six total occurrences and a few hundred individuals. It has been found in Logan, Montgomery, Pope, and Sebastian Counties.

This plant could possibly occur on similar sites on the Magazine Ranger District but because of the limited available habitat, there is likely less than 30 acres of available habitat on the Ozark-St. Francis National Forests.

Scientific collection and man-caused damage in recreation sites are this species' greatest threats.

Direct and Indirect Effects

The steepness of the terrain at many of the locations combined with the rocky substrate has probably historically protected the occurrences from disturbance due to timber harvest. Removal of the canopy would likely improve growing conditions for this tree species.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application, which place a 60-foot buffer around these sites. There would be no direct impacts on this plant species from herbicide application.

Locations where this plant is found offer the species some protection from fire because fuels there tend to be light.

Some disturbance of sites by recreational use may result in adverse impacts to individual plants. Scientific collection of seeds or disturbance of this plant are controlled and done by permit only. Implementation of any alternative addressed in this document is not likely to adversely impact this species or its habitat.

Cumulative Effects

Impacts of activities addressed in this document would be minimal because known forest populations are confined to relatively small areas, and sites are naturally protected by bluffs and steep slopes. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Bay Starvine (*Schisandra glabra*) - Regional Forester's Sensitive

Affected Environment

Bay starvine or climbing magnolia is a vine that occurs in the Atlantic and Gulf Coastal plains from North Carolina south to northern Florida, west to Louisiana and up the Mississippi Embayment into western Tennessee and eastern Arkansas

Typically it grows in woods that are clean on the forest floor, where there are few shrubs making up the mid- or understory. Typically, it occurs in the heads of ravines developed on steep slopes and is associated with vegetational species that include white oak, northern red oak, black gum, sugar maple, beech, and other tree species having mesophytic affinities. Based on personal observation, this plant is rarely, if ever, found with honeysuckle. It has been noted in young regeneration cuts as well as those that were up to 10 years old. In one harvest area, so many climbing magnolia vines were in flower, observed, and photographed that in this particular cut unit, it may have actually been the dominant plant species over a small portion of the stand.

In Arkansas, it is known only on the St. Francis National Forest from Crowley's Ridge where it appears to be restricted to four counties (Cross, Lee, Phillips, and St. Francis). It is confined to the ridge and is often found in small side drainages but rarely in open bottomland hardwoods. All indications are that climbing magnolia becomes increasingly rare as one moves from Phillips County, on the southern end of the ridge to the north end of Cross County. Within a year (1990-1991), at least 50 new sites were discovered on the St. Francis NF. Based on continuing survey and inventory, it is expected that this species will be considered very common on the St. Francis NF.

Climbing magnolia has a widespread range but with only a small number of known secure populations. It is highly threatened by competition from non-native invasives, (particularly Japanese honeysuckle), land-use conversion, and habitat fragmentation (conversion to pine plantations in Piedmont has eliminated many populations).

Direct and Indirect Effects

This species may have beneficial impacts from timber harvest and silvicultural treatment that have the effect of release on vines and allow more vertical growth in newly regenerated stands.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application. There would be no direct impacts on this plant species from herbicide application. Herbicide applications could be made to reduce or remove invasive non-native species competition from around these plants and improve growing conditions for them as a result. If done, this would improve habitat conditions and provide less competition from other vine or brush species.

Locations where this plant is found offer the species some protection from fire because fuels there tend to be light. Cool season burning is not likely to adversely impact this plant. Some individual plants could be top killed but they would soon sprout back.

Some activities proposed in each alternative such as road construction or wildlife-opening construction could adversely impact individuals but are not likely to cause a trend to federal listing or a loss of viability for this species.

Cumulative Effects

All known occurrences on the OSFNFs have been on the St. Francis National Forest. Past timber harvest treatments and increased use of herbicides have not been detrimental to this plant. Invasive non-native plants such as honeysuckle and kudzu continue to compete for available habitat. The St. Francis NF has worked to control kudzu in the past and will continue to do so in the future. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative.

Blue Ridge Catchfly (*Silene ovata*) - Regional Forester's Sensitive

Affected Environment

The range for this species is from Virginia south and west to Georgia, Alabama, Mississippi, and northern Arkansas. The plant is primarily restricted to the Appalachian physiographic region. In Arkansas, this species is found in Baxter, Benton, Cleburne, Newton, Pope, Stone, and Van Buren Counties.

Favorable habitat would include talus slopes beneath a sandstone bluff lines. This type of habitat is limited on the Forests.

Primary threats to this species include forest management practices, and to a lesser extent, land-use conversion and habitat. Other threats include grazing by deer and feral hogs, flooding by impoundment, road construction, and quarrying. Plants near roads and trails are threatened by trampling and maintenance activities. Any soil disturbance is likely to have a negative effect on this species due to the resultant erosion.

Direct and Indirect Effects

Timber harvest activity could adversely impact this species by disturbing habitat, by top killing the plant, or by opening the forest floor to more sunlight, which allows for drying the site and indirectly impacting plant habitat. Talus sites where this plant occurs will be protected by implementation of forest-wide standards, which limit harvest activities in these areas.

Silvicultural treatments and summer prescribed burning could adversely impact this species and could result in top killing the plant or opening the forest floor to more sunlight, which allows for drying the site and indirectly impacting habitat adversely. Cool season burning would likely not impact this species because above ground vegetation has died back and root stocks are below the ground surface. In addition, locations where this plant is found offer the species some protection from fire because fuels there tend to be light.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application, which place a 60-foot buffer around these sites. There would be no direct impacts on this plant species from herbicide application.

Timber harvest, road, pond, or wildlife opening construction is not likely in talus sites and is restricted by implementation of forest-wide standards; however, these treatments could impact individual plants but are not likely to cause a trend to federal listing or a loss of viability for this species.

Cumulative Effects

Impacts of activities addressed in this document would be minimal because known forest populations are confined to relatively small talus areas and sites are protected by the implementation of forest standards that limit activities in those areas,. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Royal Catchfly (*Silene regia*) - Regional Forester's Sensitive

Affected Environment

This Midwestern endemic of tall grass prairie habitats with relatively few, scattered populations are most abundant in Missouri; extirpated from Kansas and Tennessee, and considered quite rare in all other states in its range. Many remaining population remnants are along roadsides where vulnerable to construction or to changes in management of roadside vegetation.

This species is known from Benton, Boone, Bradley, Hot Springs, Newton, Searcy, Sharp, Stone, and Washington Counties in Arkansas. There are very few known locations for this plant on the Forests.

The major threat to this species is habitat destruction through agricultural practices. Prairies are no longer extensive in the Midwest and this plant species is now found principally along roadsides where prairie vegetation still occurs. Other right-of-way maintenance activities such as herbicide application (used to maintain railroad and power line rights-of-way and roadsides) and untimely mowing are additional threats Woody plant encroachment into open prairie areas is a significant threat to existing royal catchfly populations. Maintenance of open areas through the natural fire

regime has generally not occurred for well over a century and successional change is taking place. An increase in shade levels caused by woody vegetation (shrubs, trees, and vines) encroachment has reduced reproductive vigor of some extant populations.

Direct and Indirect Effects

Timber management and prescribed burning would improve habitat for this species by opening the forest canopy and promoting the growth of early seral plant communities, which would have a beneficial impact on habitat availability for this species.

Reestablishment of native grass species, the reduction of non-native grass species in openings and fields, and reestablishment of savanna and woodland habitat will increase the number of available acres where this species could occur.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application,. There would be no direct impacts on this plant species from herbicide application. Herbicide applications could be made to reduce or remove invasive non-native species, which would improve habitat conditions and provide less competition from other vine or brush species.

Cumulative Effects

Habitat loss has been a major factor in the decline of this species. Timber harvest and prescribed burning activities as described for each alternative will improve habitat for the species and open the forest floor to sunlight. There are very few known sites on the Forests and, cumulatively, activities associated with each alternative addressed here will have little or no impact on the continued existence of this species. When the impacts of any activities associated with each alternative addressed here are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative impacts on this species.

Ouachita Mountain Goldenrod (*Solidago ouachitensi*) - Regional Forester's Sensitive

Affected Environment

This plant is found in very mesic forests on moist, well-drained, gravelly soils in shaded, north-facing slopes that are significantly cooler during the hot summer weather than less shaded areas.

Ouachita Mountain goldenrod occurs in the Ouachita Mountains of Arkansas and Oklahoma and can be found in Polk and Montgomery Counties in Arkansas, and in LeFlore County in Oklahoma.

Past surveys on the Magazine Ranger District have failed to note its presence there. Habitat on that district is limited to north slopes and is less than 5,000 acres. Because this species is already found in a very narrow habitat range, anything that decreases the size of its suitable habitat could threaten its continued survival. This could include loss of habitat due to development as well as global warming.

Direct and Indirect Effects

Timber management and prescribed burning could reduce available habitat for this species by opening the forest canopy and promoting the growth of early seral plant communities, would have a negative impact on this species if it were present. This species is not known to occur on the Forests but if found, sites would be noted and protection measures called for with the implementation of forest-wide standards and all other applicable laws and policy taken.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application. There would be no direct impacts on this plant species from herbicide application.

There would be no indirect impacts on this plant species.

Cumulative Effects

This species is not known to occur on the Forests but if found, sites would be noted and protection measures called for with the implementation of forest-wide standards and all other applicable laws and policy taken. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Ozark Spiderwort (*Tradescantia ozarkana*) - Regional Forester's Sensitive

Affected Environment

This rare plant is endemic to the Ozark Mountains of Missouri, Oklahoma, and Arkansas and the Ouachita Mountains of western Arkansas and southeastern Oklahoma. There are 15 extant populations in Missouri, more than that in Arkansas, and a few in Oklahoma. The species is considered relatively secure despite some documented declines due to construction of dams/impoundments.

Ozark spiderwort does not appear to be highly habitat- specific (Foti 1994). Throughout its range, it has been recorded from rich, diverse, mainly deciduous woodlands

This species is found in Baxter, Benton, Boone, Crawford, Franklin, Johnson, Logan, Madison, Newton, Pope, Searcy, Stone, and Washington Counties in Arkansas. It has been recorded from numerous sites scattered over the western one-half of the Forests.

No immediate range wide threats such as habitat conversion are presently known. However, numerous local potential threats are reported including housing developments, roadway construction and maintenance, and herbicide use. Succession of habitat may also threaten populations by shading out individuals through increased cover from tree canopies (Smith 1992).

Direct and Indirect Effects

Intermediate timber treatments could be beneficial to this plant by opening up the forest floor and improving growth conditions. Even-aged harvest and silvicultural practices, as well as warm season prescribed burning could adversely impact this species if they were actively growing at the time of disturbance by either top killing the plant or by opening the forest floor to more sunlight, which would allow for drying the site and indirectly impacting habitat. Cool season burning is not likely to impact this species. Forest-wide standards provide a protective buffer along streamside management zones and in riparian areas where it is sometimes found.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application. There would be no direct impacts on this plant species from herbicide application.

Cumulative Effects

Because this plant is found scattered over a fairly large geographical area with many more sites, it is considered to be relatively secure. More serious threats to this species occur off forest where human population increases in Northwest Arkansas are leading to increased housing developments and road construction, which are removing available habitat.

When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Ozark Least Trillium (*Trillium pusillum var. ozarkanum*) - Regional Forester's Sensitive

Affected Environment

This species occurs in acid cherty-flinty soils of shallow draws of oak-hickory, oak-pine, or oak-chestnut woodland in the Ozark region.

While several populations have been destroyed and it is known from a limited number of extant sites, several populations contain large numbers of individuals, and appear to be able to tolerate minor habitat disturbances.

This plant is known to occur only in Missouri and in 11 Arkansas counties (Baxter, Benton, Boone, Carroll, Fulton, Madison, Marion, Montgomery, Searcy, Stone, and Washington). It occurs on limestone glades and bald knobs in the White River region.

Although known populations have not been intensely followed over a substantial period, Tucker (1983) reported that populations within the heart of the range of this species in Northwest Arkansas appear stable. However, several large populations of Ozark least trillium have been destroyed in Northwest Arkansas by water impoundments and "with urban growth and land clearing activities" (Tucker 1983).

Ozark least trillium is threatened by the loss of habitat because of logging, land conversion, and improper use of herbicides.

Direct and Indirect Effects

Intermediate timber treatments could be beneficial to this plant by opening up the forest floor and improving growth conditions. Even-aged harvest and silvicultural practices, as well as warm season prescribed burning could adversely impact this species if they were actively growing at the time of disturbance by either top killing the plant or by opening the forest floor to more sunlight, which would allow for drying the site and indirectly impacting habitat. Cool season burning is not likely to impact this species. Forest-wide standards provide a protective buffer along streamside management zones and in riparian areas where it is sometimes found.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide. There would be no direct impacts on this plant species from herbicide application.

Cumulative Effects

Because this plant is found scattered over a fairly large geographical area with many more sites, it is considered to be relatively secure. More serious threats to this species occur off forest where human population increases in Northwest Arkansas are leading to increased housing developments and road construction which are removing available habitat.

When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Nuttall's Cornsalad (*Valerianella nuttallii*) Regional Forester's Sensitive

Affected Environment

This plant is restricted to western Arkansas. It was formerly reported in eastern Oklahoma; however, occurrences have not been confirmed there recently.

This species has not been found on Ozark-St Francis NF but the Bayou, Boston Mountain, Magazine, and Pleasant Hill Ranger Districts have limited potential habitat along stream bottoms in mixed hardwood stands.

Main threats to this species include the use of chemical herbicides and fertilizers, the loss of field margin refuges, the decline of traditional systems of crop rotation, earlier harvests, and the introduction of extremely competitive crop plants.

Direct and Indirect Effects

Timber management and prescribed burning would improve habitat for this species by opening the forest canopy and promoting the growth of early seral plant communities, which would have a beneficial impact on habitat availability for this species. Streamside management zones and riparian areas where this plant occurs would be protected with the implementation of forest-wide standards which limit activities there.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application. There would be no direct impacts on this plant species from herbicide application.

Road, pond, or wildlife opening construction is not likely to occur in riparian or stream side management zones, however, these treatments could impact individual plants but are not likely to cause a trend to federal listing or a loss of viability for this species.

Cumulative Effects

Because this plant is typically found in areas where protective buffers are placed through the implementation of forest-wide standards, there would be little likelihood of adverse impacts on this plant. When effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

Ozark Cornsalad (*Valerianella ozarkana*) - Regional Forester's Sensitive

Affected Environment

The corolla (at least the tube) is coral pink to lilac or purplish-red, calyx 7 to 10 or more millimeters long with bracts subtending the flowers ciliate with purplish, glandular teeth with a white corolla. This plant is found in Benton, Carroll, Conway, Madison, Searcy, and Stone Counties in Arkansas.

The Boston Mountain (Wedington Unit), Pleasant Hill, and the Sylamore Ranger Districts have limited habitat along stream bottoms in mixed hardwood stands.

Main threats to this species include the use of chemical herbicides and fertilizers, the loss of field margin refuges, the decline of traditional systems of crop rotation, earlier harvests, and the introduction of extremely competitive crop plants.

Direct and Indirect Effects

Timber management and prescribed burning would improve habitat for this species by opening the forest canopy and promoting the growth of early seral plant communities, which would have a beneficial impact on habitat availability for this species. Streamside management zones and riparian areas where this plant occurs would be protected with the implementation of forest-wide standards that limit activities there.

If herbicide applications were to be made near plants, they would be protected by the implementation of forest-wide standards for herbicide application. There would be no direct impacts on this plant species from herbicide application.

Road, pond, or wildlife opening construction is not likely to occur in riparian or stream side management zones however these treatments could impact individual plants but are not likely to cause a trend to federal listing or a loss of viability for this species.

Cumulative Effects

Because this plant is typically found in areas where protective buffers are placed through the implementation of forest-wide standards, there would be little likelihood of adverse impacts on this plant. When effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects on this species.

SNAIL

Magazine Mountain Shagreen (*Mesodon magazinensis*) - Threatened

Affected Environment

This land snail is described as having a dusky brown to buff-colored shell, and is endemic to Mt. Magazine in Logan County. It is unknown elsewhere on the OSFNFs or anywhere else. Suitable habitat occurs on about 540 acres in two locally disjunct areas of the mountain (1) on the north facing slopes of the summit and (2) on north facing slopes of Bear Hollow. Monitoring has not documented the snail in Bear Hollow in recent years.

This species is known to occur in a very limited area along the north-facing slopes of Mt. Magazine. Habitat is steep talus sites in rich mesic hardwood forest. This snail prefers a cool, moist climate; it moves deeper into rock crevasses during warm, dry weather,

The restricted range of the Magazine Mountain shagreen makes it vulnerable to any land use change or activity that would have an adverse effect on the talus slopes where it is found. Toxic chemical application, runoff, or drift (i.e. herbicides,

pesticides, and fire-retardant slurries) may have a detrimental impact on the species. In addition, timber harvest treatments that open the forest canopy may adversely impact this species by allowing more sunlight to the forest floor and increasing ground temperatures, thus, reducing moisture levels on the forest floor.

Direct and Indirect Effects

The restricted range of the Magazine Mountain shagreen makes it vulnerable to any land use change or activity that will have an adverse effect on the talus slopes it inhabits. Toxic chemical application, runoff, or drift (i.e., herbicides, pesticides, and fire-retardant slurries) may have a detrimental impact on the species. In addition, timber harvest treatments that open the forest canopy may adversely affect this species by allowing more sunlight to the forest floor and increasing ground temperatures, thus, reducing moisture levels on the forest floor.

The species is located inside the protected Magazine Mountain Special Interest Area. Other similar habitat areas are covered by forest-wide standards that prohibit timber harvest, road construction, or recreational development on talus slopes.

Fire suppression activities on the north face of Mt. Magazine could adversely affect this species if fire retardant were dropped on the talus area where this species occurs. Implementing forest-wide standards will prohibit the use of aerially applied fire retardant on the north face of Mt. Magazine and will eliminate this problem.

Forest-wide standards allow for prescribed burning in these sites only in cooler months when this small, less mobile species is far enough below the surface to escape harm. By implementing the forest-wide standards, it is possible, but not probable, that individuals could be harmed. Most burn operations will take place under conditions where the talus areas will carry only patchy, low intensity fire. Prescribed burning will be done following parameters that maintain canopy structure and will not damage the mesic conditions this species requires.

Cumulative Effects

Because the known population and range of this species is confined to the Ozark NF, forest-wide standards have been included to protect sites where it occurs. Even with the combination of impacts from past, present, and future activities occurring on public and private lands, no cumulative effects to the Magazine Mountain shagreen are anticipated with implementation of the Revised Forest Plan.

MUSSELS

Fat Pocketbook (*Potamilus capax*) - Endangered

Affected Environment

The fat pocketbook has undergone a marked decline in its overall range and is now limited to two regions (lower Wabash and Ohio rivers and the St. Francis River

drainage and portions of the boot heel in Missouri). In areas where it occurs, the fat pocketbook appears stable. This mussel species inhabits large rivers making them very susceptible to fouling by exotic zebra mussels, which could drastically reduce populations in a short period. Currently, the fat pocketbook is found in the St. Francis River, approximately 20 miles upstream from the St. Francis NF near Madison, Arkansas.

Current land uses in the upper reaches of the St. Francis River drainage basin have degraded water quality to the point that no potential habitat for this species is expected in the lower reach of the river adjacent to the St. Francis NF. The historical range for this species included the approximately four miles of the St. Francis River adjacent to the St. Francis NF, and the lower reaches of the White River at least 100 miles downstream of the Sylamore Ranger District on the Ozark NF. No known historical populations occurred in the White River system on lands currently under Forest Service ownership.

Direct and Indirect Effects

The greatest threats to fat pocketbook are construction of impoundments; dredging for navigation and flood control; agricultural and industrial runoff; sedimentation; commercial clamming; and the introduction of the zebra mussel (competition). Found in a few locations within its native range, the species has a reduced extent. Restricted movement of the host fish (freshwater drum and possibly other species) may also be a factor in the decline of this species (USFWS 1997). For populations of fat pocketbook near the Forests, potential management influences include sedimentation, toxic chemicals, altered flows, and blockage of host fish passage associated with road crossings. The Revised Forest Plan will have no effect on the fat pocketbook since all known populations exist in the St. Francis River upstream of Forest Service lands. If populations are found near/downstream of the Forests, forest-wide and riparian standards will protect the fat pocketbook, its habitat, and the host species from sediment and chemicals released during management activities.

There were no differences observed in sediment increases among alternatives ("Water Resources" section). All the alternatives except Alternative A contain management prescriptions for riparian areas. Standards and objectives are the same for all alternatives. Given this information, Alternatives A is the least acceptable alternative from a fat pocketbook standpoint. Alternatives B, C, D, and E are the most acceptable alternatives for fat pocketbook.

Cumulative Effects

No cumulative effects are expected from management activities proposed with any alternative. Activities on private lands outside Forest Service control in sections of the St. Francis River upstream of the St. Francis NF could lead to long-term viability concerns for this species. This species has not been found on the Forests, although extensive surveys of the St. Francis River have been completed. The main

opportunities for the Forests to aid in the fat pocketbook's recovery are through land acquisition, working with landowners to protect riverine ecosystems, and education of the public about this species.

Pink Mucket (*Lampsilis abrupta*) - Endangered

Affected Environment

This mussel is characterized as a large river species although in recent years it has been able to survive and reproduce in impoundments with river-lake conditions but never in standing pools of water (USFWS 1985). This species is found in waters with strong currents, rocky substrates, and depths up to about one meter as well as in deeper waters with slower currents and sand and gravel substrates.

This species occurs in gravel or sand in the lower Mississippi and Ohio rivers and their larger tributaries. The largest population in Arkansas appears to be in the White River. This species is not found on the Forests but is in a watershed, which could be impacted by actions on the Sylamore Ranger District.

Known threats to the mussel include modification of habitat (e.g., dams and dredging), degradation of water quality, and over-harvest by the commercial mussel industry.

Direct and Indirect Effects

The greatest threats to pink mucket are from habitat loss from dam construction, channelization, and dredging. Pollution, sedimentation, illegal harvesting, and introduction of the zebra mussel (competition) also threaten this species. The species is wide ranging, but is very rare within its range. The small populations can also cause problems with reproductive success and loss of genetic diversity (INHS 1997). For populations of pink mucket near the Forests, potential management influences include sedimentation, toxic chemicals, and altered flows. Forest-wide and riparian standards will protect the pink mucket and its habitat from sediment and chemicals released during management activities. If new water use authorizations occur, the same standards will apply and should result in no effects.

There were no differences observed in sediment increases among alternatives ("Water Resources" section). All the alternatives except Alternative A contain management prescriptions for riparian areas. Standards and objectives are the same for all alternatives. Given this information, Alternative A is the least acceptable alternatives from a pink mucket standpoint. Alternatives B, C, D, and E are the most acceptable alternatives for pink mucket. There would be no direct effects on this species with any alternative addressed here.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the pink mucket is found could have an impact on this species. The continued

expansion of the distribution of the zebra mussel as well as alterations of major rivers in Arkansas and increases in sediment from agriculture and urban areas could lead to continued loss of habitat for this species. For the pink mucket, the main avenue for the Forests to aid in this species recovery is through land acquisition, working with landowners to protect riverine ecosystems, and education of the public about this species. Given forest-wide and riparian standards and its current distribution, forest management activities on the Forests for any of the alternatives are not likely to adversely affect the pink mucket.

Scaleshell Mussel (*Leptodea leptodon*) - Endangered

Affected Environment

This species occurs in riffles with moderate to high gradients in creeks to large rivers. This species is typically associated with riffles, relatively strong currents, and substrate of mud, sand, or assemblages of gravel, cobble, and boulder. It is restricted to rivers with relatively good water quality in stretches with stable channels.

This species is rare in Missouri, of special concern in Michigan, and still found in three river systems that could potentially be affected by projects on the OSFNFs; however, no recent occurrence records exist. This species has not been found on the Forests.

Rivers that the scaleshell mussel is documented from are the St. Francis River, White River, and Frog Bayou in western Arkansas.

Primary threats to this species include the alteration and inundation of channels; siltation from agriculture and clear-cutting; and chemical and organic pollution.

Direct and Indirect Effects

The greatest threats to the scaleshell mussel are sedimentation, dams, pollution, and the introduction of the zebra mussel (competition). The species is historically believed to have a reduced range, but it has become even further reduced with only 14 of the known 55 historical populations remaining. Restricted movement of the host fish may also be a factor in the decline of this species (USFWS 1997b). For populations of scaleshell near the Forests, potential management influences include sedimentation, toxic chemicals, altered flows, and blockage of host fish passage associated with roads and crossings. Forest-wide and riparian standards will protect the scaleshell and its habitat from sediment and chemicals released during management activities and allow for proper maintenance and construction of passage-friendly road crossings. If new water use authorizations occur, the same standards will apply and should result in no effects.

There were no differences observed in sediment increases among alternatives ("Water Resources Section"). All the alternatives except Alternative A contain management prescriptions for riparian areas. Standards and objectives are the same for all alternatives. Given this information, alternative A is the least

acceptable alternatives from a scaleshell standpoint. Alternatives B, C, D, and E are the most acceptable alternatives for scaleshell. There would be no direct effects on this species with any alternative addressed here.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the scaleshell is found could have an impact on this species. The continued expansion of the distribution of the zebra mussel as well as alterations of major rivers in Arkansas and increases in sediment from agriculture and urban areas could lead to continued loss of habitat for this species. For the scaleshell, the main avenue for the Forests to aid in this species recovery is through land acquisition, working with landowners to protect riverine ecosystems, and education of the public about this species. Given forest-wide and riparian standards and its current distribution, forest management activities on the Forests for any of the alternatives will have no affect on the scaleshell mussel.

Neosho Mucket (*Lampsilis rafinesqueana*) - Regional Forester's Sensitive

Affected Environment

The Neosho mucket is a Regional Forester's Sensitive freshwater mussel endemic to the Illinois and Neosho River drainages in Arkansas, Kansas, Missouri, and Oklahoma. It is found in second order or larger streams, with moderately flowing water over fine to medium gravel substrates. It has been found on the OSFNFs in watersheds containing the Wedington Unit of the Boston Mountain Ranger District. The species is showing decline across its range.

Direct and Indirect Effects

The primary threats to the Neosho mucket are impoundments and land development for urban and agricultural land uses. Land development causes sedimentation and loss of habitat from alteration to the stream channel. Blockage of host fish passage associated with dam and road crossings can also play an important role in the decline of this species. There were no differences observed in sediment increases among alternatives ("Water Resources Section"). All the alternatives except Alternative A contain management prescriptions for riparian areas. Standards and objectives are the same for all alternatives. Given this information, Alternative A is the least acceptable alternative from this species' standpoint. Alternatives B, C, D, and E are the most acceptable alternatives for the Neosho mucket. There would be no direct impacts on this species with any alternative addressed here.

Cumulative Effects

The impact of activities on private lands in the watersheds where the Neosho mucket is found could have an impact on this species. The watersheds in which this species are found are in a part of Arkansas that is rapidly being developed, which increases the probability that this species will have viability issues in Arkansas in the future. For

the Neosho mucket, the main avenue for the Forests to aid in this species' recovery is through land acquisition, working with landowners to protect riverine ecosystems, and education of the public about this species. Given forest-wide and riparian standards and its current distribution, forest management activities on the Forests for any of the alternatives may impact individuals but are not likely to cause a trend to federal listing or a loss of viability for the Neosho mucket.

INSECT/ISOPOD

American Burying Beetle (*Nicrophorus americanus*) - Endangered

Affected Environment

The American burying beetle (ABB) exhibits broad vegetational tolerances, though natural habitat may be mature forests. This species has been recorded from grassland, old-field shrub land, and hardwood forests. Vegetational community associations range from large mowed and grazed fields to dense shrub thickets. Oklahoma habitats vary from deciduous oak-hickory and coniferous forests atop ridges or hillsides to deciduous riparian corridors and pasturelands on valley floors. Soil characteristics are also important to the beetle's ability to bury carrion (decaying flesh of a dead body when regarded as food). Extremely xeric, saturated, or loose sandy soils are unsuitable for these burying activities. Historic collections were made when forests had been cleared and the land was largely agricultural and habitats associated with these collections were not clearly described. Adults live primarily above ground and eggs are laid in soil adjacent to a buried carcass.

Potential habitat on the Forests could include any forested acres and fields that are not rock covered or covered in water, which is approximately 900,000 acres.

This species has exhibited a dramatic range collapse in recent times, having been reduced to less than 10 percent of its original historic range and probably much less than 1 percent of its original occupied habitat. There are certainly more than 5 and probably fewer than 20 extant populations, with some at relatively low densities. New populations will occasionally be found but it seems possible that there could be over 20 remaining populations. It is difficult to evaluate precise numbers of viable occurrences. There have been only two occurrence records noted with both being on the Magazine Ranger District despite numerous surveys across the Forests.

Threats include habitat fragmentation, insecticides, and bug-zapper use as well as disturbance of soils and competition from vertebrate scavengers. Continued widespread population decline indicates vulnerability and/or a loss of suitably sized carrion.

In the past, surveys across the Forests have noted the presence of this species only on the extreme western edge of the Mt. Magazine Ranger District in Logan County, Arkansas. The Forests will continue to survey and monitor for this species. Because of the mobility of this nighttime flying insect, new sites may be found on the Forests.

Direct and Indirect Effects

Direct effects include ground-disturbing activities that may result in harm to ABB individuals, as buried carrion is the substrate of choice for depositing their eggs. Ground-disturbing activities that could potentially harm ABB individuals include some forest regeneration site preparation activities as well as construction, reconstruction, maintenance or decommissioning of roads, fire lines, trails, and facilities. Adherence to the US Fish and Wildlife Service baiting-away protocol at project areas prior to implementation of ground disturbing management activities would reduce or minimize the direct effect to individuals.

Generally, the indirect effects of forest management activities will be beneficial to American burying beetle habitat in the preferred alternative. Increased establishment and maintenance of early seral habitat will provide enhanced habitat for this species' prey base of small vertebrate carrion production. Indirect beneficial effects on this insect's habitat would primarily involve maintenance and/or enhancement of the grass/forb/shrub vegetation condition that harbors the small mammal and other potential carrion populations. The cumulative effects of forest management activities in the preferred alternative on ABB habitat would be continued enhancement of the grass/forb habitat, providing conditions beneficial to this species, but ground-disturbing activities may harm individuals.

A determination of “Likely to Adversely Affect” is made for the American burying beetle on the western portion of the Magazine Ranger District because ground-disturbing activities may harm individuals and there is a possibility that operation of heavy equipment could crush individuals. Because bait-away protocols will be used, the likelihood of killing very many individuals in a single management action is remote and disturbance should improve future habitat for the species. Elsewhere on the Forests, there would be no effect on this species.

Cumulative Effects

Threats such as habitat fragmentation, insecticide use, and bug-zapper use will continue on private lands. Continued widespread population decline indicates vulnerability and/or a loss of suitably sized carrion in part due to urbanization and human population increases.

Habitat changes brought on by treatments addressed here will increase the number of suitably sized carrion and indirectly improve foraging opportunities for this species.

By following forest-wide standards developed for this species, which calls for the trapping and relocation of beetles immediately prior to the start of any ground-disturbing activity on projects where the ABB occurs; there will be no direct effects on this species. Treatments proposed with each alternative would likely improve, indirectly, the foraging habitat for this species by increasing the number of small mammals and birds, which are typically, associated with disturbance and early seral habitat conditions. For this reason, there would be no negative indirect effect on this species.

Neoarctic Paduneillan Caddisfly (*Paduniella nearctic*) - Regional Forester's Sensitive

Affected Environment

This species is endemic to Arkansas and Missouri and is found in creeks to medium rivers. It was previously thought in Arkansas to only occur in Devils Den State Park, but the distribution was later expanded to cover the 4th level watersheds of Robert S. Kerr Reservoir, Frog-Mulberry, Dardanelle Reservoir, and Little Red. It has recently been identified from the Buffalo River National Park in the Buffalo River 4th level watershed (Mott and Laurans 2004) and on the Forests at the Barkshed Recreation Area on the Sylamore Ranger District in North Sylamore Creek (4th level watershed) (Moulton and Stewart 1996). The distribution of this species has not been extensively studied. This species lives in running water where it makes a tube-like retreat of sand, organic matter, and silk that it attaches to rocks and logs. It feeds on periphyton and fine particulate matter around its retreat (Merritt and Cummings 1996). This species is in the family Psychomyiidae, which is known to be intolerant of disturbance. On a scale of one to ten (1 being intolerant; 10 being tolerant), this family is a three.

Direct and Indirect Effects

This species seems to have a low tolerance for sedimentation. The use of forest standards and Arkansas' BMPs in management activities will lower the potential for any effect of sedimentation on this species of caddisfly. The use of streamside management zones and the addition of a Riparian Corridor Management Area (3.I) in the proposed alternatives will help to stabilize the aquatic community and actually may increase the available habitat for this species. Because caddisflies are terrestrial as adults and are able to fly, the Neoartic paduneillan caddisfly should be able to colonize new available habitat fairly quickly.

Cumulative Effects

The impact of agricultural and urban areas not in Forest Service ownership in the watersheds where the Neoartic paduneillan caddisfly is found could have an impact on this species. Arkansas state parks, state wildlife management areas, and national parks that are in these watersheds may also play a positive role in protecting this species by providing suitable habitat where disturbance is limited. Individual projects on the Forests may impact individuals, but overall forest management activities are not likely to cause a trend to federal listing or a loss of viability for this species.

Isopod (*Lirceus bicuspidatus*) - Regional Forester's Sensitive

Affected Environment

Isopod is endemic to Arkansas. The actual distribution of this species is not well known or understood. It is found in streams and possibly in caves that have moving water. This species has been found on the Forests.

Direct and Indirect Effects

The main impacts to this species seem to be activities that interfere with habitat and water quality. This could occur from the use of chemicals, dam construction, stream alterations, or sediment increases. Populations near the OSFNFs would be most susceptible to management activities like herbicide use, pesticide use, and fire retardants but these treatment actions are typically not widespread and impacts are limited to the sites where they occur. It could also be susceptible to sediment increases from activities like logging, road construction, cattle grazing, burning, and over abundant recreational use (e.g., OHVs).

There were no differences observed in sediment increases among alternatives ("Water Resources Section"). All the alternatives except Alternative A contain management prescriptions for riparian areas. Standards and objectives are the same for all alternatives. Given this information, Alternative A is the least acceptable alternatives from a Isopod standpoint. Alternatives B, C, D, and E are the most acceptable alternatives for isopod.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the isopod is found could have a negative effect on this species. Given forest-wide and riparian standards, forest management activities on the OSFNFs for any of the alternatives may impact individuals but is not likely to cause a trend to federal listing or a loss of viability for Isopod.

CRAYFISH

Cave Crayfish (*Cambarus aculabrum*) - Endangered

Affected Environment

This crayfish lives in streams in caves and subterranean habitats. It is known from two cave streams in Benton County, Arkansas (Hobbs and Brown 1987). One of the current known populations, Logan Cave, is protected as a National Wildlife Refuge by the U.S. Fish and Wildlife Service. Currently, no populations of the cave crayfish have been found on the OSFNFs. Recharge areas for known cave populations do not extend on to OSFNFs lands.

Direct and Indirect Effects

The greatest threats to cave crayfish are sediment and the degradation of groundwater quality. The species has very few small populations with very low reproductive rates. Because this species has not been found on the Forests despite surveys for it, and because it does not occur in recharge areas with any Forest Service ownership, there would be no direct or indirect effects on this species.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the cave crayfish is found could have a negative impact on this species. During attempts to inventory this species in two of the known cave sites, no more than six individuals have been seen in each cave. Because if its limited range and isolated populations, this species is vulnerable to catastrophic events such as accidental toxic chemical spills. Given forest-wide, riparian, and karst standards and the known distribution of this species, forest management activities on the Forests for any of the alternatives will have no cumulative effect on cave crayfish.

Hell Creek Cave Crayfish (*Cambarus zophonastes*) - Endangered

Affected Environment

Hell Creek Cave crayfish lives in streams in caves and subterranean habitats. It is known from one cave stream in Stone County, Arkansas. The species has very few small populations with very low reproductive rates. Population estimates in Hell Creek Cave of this crayfish are less than 50 individuals. Hell Creek Cave is owned and protected by the Arkansas Natural Heritage Commission. Currently no populations of the Hell Creek Cave crayfish have been found on the OSFNFs. Recharge areas for known cave populations do not extend on OSFNFs

Direct and Indirect Effects

The greatest threats to the Hell Creek Cave crayfish are sediment and the degradation of groundwater quality. Because this species has not been found on the Forests despite surveys for it, and because it does not occur in recharge areas with any Forest Service ownership, there would be no direct or indirect affects on this species.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the Hell Creek Cave crayfish is found could have a negative impact on this species. Herbicide use on nearby power lines, storage tanks for petroleum near the caves, and runoff from new home construction in Mountain View, Arkansas, are all activities that present possible impacts for Hell Creek Cave crayfish. Given forest-wide and riparian standards and the known distribution of this species, forest management activities on the Forests for any of the alternatives will have no effect on Hell Creek Cave crayfish

William’s Crayfish (*Orconectes williamsi*) - Regional Forester's Sensitive

Affected Environment

William’s crayfish is associated with pools and is found in small streams. It found under rocks in small, cool, and shallow headwater streams. The William’s crayfish is

known from streams in the headwaters of the White River system in Arkansas and Missouri. It has a very limited distribution and seems to be rare in the areas where it is found. The species was found on the Pleasant Hill Ranger District during surveys (Robison, 1997)

Direct and Indirect Effects

The greatest impact to this species has been the fragmentation of populations by dams and reservoir construction. There is also a possible impact of alterations of habitat from recreational use on the White River and its tributaries. Actions proposed with any alternative would have little impact on this species.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the William's crayfish is found could have a negative effect on this species. Given forest-wide and riparian standards and the known distribution of this species, forest management activities on the Forests for any of the alternatives may impact individuals but are not likely to cause a trend to federal listing or a loss of viability for William's crayfish.

FISH

Pallid Sturgeon (*Scaphirhynchus albus*) - Endangered

Affected Environment

Pallid sturgeon is restricted to the larger channels of the Mississippi-Missouri River systems where it is uncommon or rare. It is threatened by habitat degradation due to impoundments that have decreased turbidity, inundated much of the sturgeon's former habitat, and interfered with movement of this species. The hybridization with shovelnose sturgeon may also be a major threat. There have been two records from Arkansas; one from the Mississippi River and one from the St. Francis River (approximately 25 miles upstream of the Forests). All of the St. Francis River adjacent to forestlands provide potential habitat for this species (approximately 4 miles).

Direct and Indirect Effects

Actions proposed with any alternative would not directly impact this very rare species. The biggest threats to the survival of this species include the construction of impoundments and hybridization. Actions addressed here would have no effect on this species.

Cumulative Effects

The impact of activities on lands not in Forest Service ownership in the watersheds where the pallid sturgeon is found could have an impact on this species. For the pallid sturgeon, the main avenue for the Forests to aid in this species recovery is

through land acquisition, working with landowners to protect riverine ecosystems, and education of the public about this species. Currently, no populations of the pallid sturgeon have been found on the Forests. Given forest-wide and riparian standards and the known distribution of this species, forest management activities on the Forests for any of the alternatives will not affect this species.

Ozark Cavefish (*Amblyopsis rosae*) - Threatened

Affected Environment

The Ozark cavefish is a true cave dweller, reaching a total length of about two inches. This fish is presently known in 28 sites distributed over 6 counties in 3 states (Benton County, Arkansas; Delaware County, Oklahoma; and Jasper, Lawrence, Greene, and Newton Counties, Missouri). The verified historic range was slightly larger, but was still within the same general geographic area as the present range. Potential habitat is less than five acres forest-wide.

Threats to this species include over-collecting and pollution, which are thought to be the prime factors in the decline of the Ozark cavefish. The low reproductive abilities, confined habitat, and inability to elude captors make it vulnerable to over-collection. Another factor that may have contributed to the species' status is the decline of the endangered gray bat. The food supply of the Ozark cavefish is dependent upon an outside energy source. The largest populations occur in caves used by the gray bat, where the guano forms the cave's primary energy source.

Direct and Indirect Effects

The greatest threats to Ozark cavefish are removal by collectors for sale to the aquarium industry and the degradation of groundwater quality. The species has very few populations that are small in size with very low reproductive rates (Robison and Buchanan 1984, Pflieger 1991). Because of its limited range, this species is vulnerable to catastrophic events such as accidental toxic chemical spills. For populations of Ozark cavefish near the Forests, potential management influences include sedimentation, toxic chemicals, and altered flows. Forest-wide and riparian standards will protect the Ozark cavefish and its habitat from sediment and chemicals released during management activities. If new water use authorizations occur, the same standards will apply and should result in no effects.

There were no differences observed in sediment increases among the alternatives ("Water Resources Section"). All the alternatives except Alternative A contain management prescriptions for riparian areas. Standards and objectives are the same for all alternatives. Given this information, Alternative A is the least acceptable alternatives from Ozark cavefish standpoint while Alternatives B, C, D, and E are the most acceptable alternatives for Ozark cavefish.

Cumulative Effects

Currently, no populations of the Ozark cavefish have been found on the Forests. In addition, recharge areas for known cave populations do not extend onto forestlands. Because of its limited populations in areas off forest, this species is very vulnerable to unexpected activities like chemical spills and illegal collection. These types of activities can also lead to the loss of genetic diversity within the population, which can lead to loss of the species within an area. When the effects of any of the alternative are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects. For the Ozark cavefish, the main avenue for the Forests to aid in this species' recovery is through land acquisition, working with landowners to protect cave ecosystems, and education of the public about this species. Given forest-wide and riparian standards and the known distribution of this species, forest management activities on the Forests for any of the alternatives will have no effect on Ozark cavefish or its habitat.

Ozark Shiner (*Notropis ozarcanus*) - Regional Forester's Sensitive

Affected Environment

This species is a Regional Forester’s Sensitive Species. It prefers high-gradient stream sections below riffles in slight to moderate current in large streams and rivers. Ozark shiner is endemic to the Ozark Uplands of northern Arkansas and southern Missouri. It has been found in the White and Black River systems, and a disjunct population in the Illinois River system. It is most abundant in the Buffalo River. The species is found in several widely scattered populations but those populations seem to have very low densities (Robison and Buchanan 1984).

Direct and Indirect Effects

The greatest threats to Ozark shiner are reservoir construction (loss of habitat). Because of the low densities, this species is vulnerable to the loss of populations with no likelihood of reestablishment. For populations of Ozark shiner on and/or near the Forests, potential management influences include altered flows. The likelihood of fragmenting populations with road crossings and other stream structures could be detrimental to Ozark shiner given its already apparent low population densities. New road/stream crossings will be built to a standard that will allow for fish passage. Preexisting road/stream crossings could still potentially affect the migration and movement of this species. All the alternatives except Alternative A contain a Riparian Corridor Management Area (E.I). Standards are the same for all alternatives.

Cumulative Effects

The impact of agricultural and urban areas not in Forest Service ownership in the watersheds where the Ozark shiner is found could have an impact on this species. With the spotty distribution of this species, natural or human-caused disturbance

could lead to losses of smaller populations. With the distance between some populations and barriers like dams and road crossings in place, Ozark shiner may have difficulty recolonizing some areas. Given forest-wide and riparian standards, forest management activities on the Forests may impact individuals but should not lead to a loss of viability for this species.

Longnose Darter (*Percina nasuta*) - Regional Forester's Sensitive

Affected Environment

This species is a Regional Forester's Sensitive species. It is found in clear, silt-free upland large streams and small rivers with cobble and gravel bottoms. Longnose darter is found in several widely scattered populations but those populations seem to be very small. It is considered a rare species in Arkansas (Robison and Buchanan 1984; Quinn and Kwak 2003; Robison 1992; City of Fort Smith 1989).

Direct and Indirect Effects

The greatest threats to longnose darter are reservoir construction (loss of habitat), sedimentation, and pesticides. Because of its scattered range, this species is vulnerable to the loss of populations with no likelihood of reestablishment. For populations of longnose darter on and/or near the Forests, potential management influences include toxic chemicals and altered flows. Forest-wide and riparian standards will protect the longnose darter and its habitat from chemicals released during management activities. New road/stream crossings will be built to a standard that will allow for fish passage. Preexisting road/stream crossings could still potentially affect the migration and movement of this species. There were no differences observed in sediment increases among the alternatives (*Water Resources Section*). All the alternatives except Alternative A contain a Riparian Corridor Management Area (3.I). Standards are the same for all alternatives.

Cumulative Effects

The impact of agricultural and urban areas not in Forest Service ownership in the watersheds where the longnose darter is found could have an impact on this species. With the spotty distribution of this species, natural or human-caused disturbance could lead to losses of smaller populations. With the distance between some populations and barriers like dams and road crossings in place, longnose darter may have difficulty recolonizing some areas. Given forest-wide and riparian standards, forest management activities on the Forests may impact individuals but should not lead to a loss of viability for this species.

Southern Cavefish (*Typhlichthys subterraneus*) - Regional Forester's Sensitive

Affected Environment

This species is a Regional Forester's Sensitive Species. It has been found at only three sites (caves and springs) in Arkansas, but has a greater distribution outside of

Arkansas. Presently, the southern cavefish has not been found on the Forests, though potential habitat does exist. The greatest threats to southern cavefish are sediment and the degradation of groundwater quality. The species has very few small populations with very low reproductive rates (Robison and Buchanan 1984). Because of its limited range and isolated populations, this species is vulnerable to catastrophic events such as accidental toxic chemical spills.

Direct and Indirect Effects

Because this species has not been found on or near the Forests and because it isn't found in the recharge area with any Forest Service ownership, there would be no direct or indirect impacts on this fish species. Forest-wide and riparian standards will protect the southern cavefish and its habitat from sediment and chemicals released during management activities.

Cumulative Effects

The impact of agricultural and urban areas not in Forest Service ownership in the watersheds where the southern cavefish is found could have an impact on this species. Because the species has not been found on the Forests, individual projects and overall forest management activities on the Forests are unlikely to have any impact on this species. There would be no cumulative impacts with any alternative addressed here.

REPTILE/AMPHIBIAN

American Alligator (*Alligator mississippiensis*) - Threatened

Affected Environment

Habitat for this species is described as fresh and brackish marshes, ponds, lakes, rivers, swamps, bayous, and larger spring runs. It basks on land next to water and digs dens in river or lake margins or in marshes. It spends cold winters and drought periods in dens.

This species occurs in southeastern North America and the population has shown rapid recovery with enforcement of protective legislation. Populations are stable or increasing over most of its range. There are currently fourteen million acres of alligator habitat nationwide. This large reptilian species is no longer biologically endangered or threatened; however, it is listed by USFWS as threatened throughout its entire range due to similarity of appearance to other endangered or threatened crocodilians. The potential habitat for the American alligator is about 1,600 acres of permanent open water and cypress/tupelo swamp found on the St. Francis NF. There are records of their occurrence on the St. Francis NF.

The American alligator's population has declined due to over-harvest and habitat loss. Currently, the primary threat is loss and degradation of habitat due to recreational and agricultural use as well as other land development.

Direct and Indirect Effects

Since this species occurs only on the St. Francis NF where it is restricted to a few small ponds and lakes, impacts of all alternatives will be minimal. With the implementation of forest-wide standards, which will reduce disturbance in these habitat sites, there would be no direct effects on this species. Ponds and lakes where they occur now will be protected by forest-wide standards, which limit activities in around these sites. Also, new road construction in these sensitive sites will be reduced. Because effects are localized, there would be no indirect effects on the reptilian species.

Cumulative Effects

There will be no habitat degradation or agricultural development with any alternative addressed here. When the effects of any alternative addressed in this document are combined with potential effects of all other planned or anticipated projects on both public and private lands, there would be no known cumulative effects.

Oklahoma Salamander (*Eurycea tynerinsis*) - Regional Forester's Sensitive

Affected Environment

The Oklahoma salamander, a Regional Forester's Sensitive Species, is a small, slender, permanently aquatic salamander that retains gills throughout its life. It is confined to small, cold, clear, cherty gravel-bottomed streams and springs with temperatures not exceeding 24ºC and to altitudes less than 305 meters. This species seems to have a temperature preference of 11.5 to 24.0ºC. There also seems to be a correlation between the location of this species and the geologic formation of Ordovician-Silurian rock strata. This species is most often found and observed in shallow slow moving water (Trauth et al. 2004). This species is most vulnerable due to its low population density and potential habitat loss caused by gravel mining operations and sedimentation. This species has been located only on the Wedington Unit of the Boston Mountain RD.

Direct and Indirect Effects

For populations of Oklahoma salamander near the Forests, potential management influences include sedimentation and altered channels. Forest-wide and riparian standards will help to protect the Oklahoma salamander and its habitat from sediment and channel alteration activities. Given the forest-wide and riparian standards, forest management activities on the Forests may impact individuals locally but should not lead to a loss of viability for this species.

Cumulative Effects

Even given forest-wide and riparian standards for forest management activities on the Forest; the impact of activities on lands not in Forest Service ownership in the watersheds where the Ozark salamander is found could have a negative impact on

this species. Because of this potential, any of the alternatives may impact individuals but are not likely to cause a trend to federal listing or a loss of viability.

BIRDS

Interior Least Tern (*Sterna antillarum athalassos*) - Endangered

Affected Environment

This bird species builds nests mainly on riverine sandbars or salt flats that become exposed during periods of low water (Hardy 1957). Because of vegetational succession and/or erosion, preferred nesting habitat typically is ephemeral.

Although a widespread species, it is only found in Arkansas along the Mississippi and Arkansas River systems where it nests on sandbars. This species is distributed over a relatively large area and on the Forests is found only on the St. Francis NF.

Since least terns always nest near water, they are vulnerable to flood inundation and seem to seek higher ground. In addition, they are quite susceptible to predation.

Direct and Indirect Effects

Implementation of forest-wide standards for riparian and floodplain protection will limit disturbance to habitat needed for this species. Because this species is found only on sand bars, little active management will take place here. There would be no direct effect on this avian species with the implementation of any of the alternatives addressed here. Because of forest-wide standards that limit management actions within streamside management zones, there would be no indirect effects on this species.

Cumulative Effects

There would be no cumulative effects on this species from past, present or foreseeable future actions with the implementation of any of the alternatives. Because of the restricted area in which this species lives, there is a high unlikelihood that any actions which may occur would directly or indirectly impact these areas.

Ivory-billed Woodpecker (*Campephilus principalis*) - Endangered

Affected Environment

The ivory-billed woodpecker, long thought to be extinct, has been rediscovered in the Big Woods Corridor in Arkansas, according to a paper published in the journal *Science*. Although never abundant, less than a century ago the ivory-billed was widely distributed across the southeastern United States and found in Cuba. The loss to logging of its favored habitat (swampy bottomland forest) caused its decline and

apparent disappearance in the U.S. The bird survived in the rugged mountains of eastern Cuba through at least the late 1980s, but no confirmed sightings had been made since.

The ivory-billed woodpecker once ranged through swampy forests in the southeastern and lower Mississippi valley states from North Carolina to Florida, west to eastern Texas and Arkansas. Reports from the 1800s tell of sightings in Kentucky, Missouri, and Oklahoma. John James Audubon reported ivory-billed woodpeckers as far north as the junction of the Ohio and Mississippi rivers around 1825.

Ivory-bills are believed to mate for life. Females usually lay about three china-white eggs per clutch. The parents share the duties of incubating the eggs and raising the young, which usually leave their parent's territory at the end of the season. A pair of ivory-bills is estimated to need six square miles of uncut forest, roughly 36 times as much territory as pileated woodpeckers require. Ivory-bills excavate trees to make nest holes, usually 40 feet or higher above the ground. The openings are typically oval, 4 and 6 inches in size, extending 20 inches or more down into the tree.

Beetle larvae are the primary food for ivory-bills. When beetle larvae bore through the bark to feed on the sapwood beneath, ivory-bills use their elongated beaks to pry bark from the trees and expose the larvae. Later, other woodpecker species mine deeper into the dying trees for insects. Thus, ivory-bills do not, for the most part, compete for food with other woodpeckers, and their territories can overlap. The big birds have few natural predators. Although collectors took a toll on ivory-bill populations, the main reason for the species' decline was the annihilation of the forests where they lived.

Direct and Indirect Effects

Vegetation management and road building have the potential to affect the ivory-billed woodpecker or its habitat, especially near rivers, lakes, or other wetlands. The use of prescribed fire for management could have mixed impacts to the species by burning some snags while creating new snags in areas where there are now few. Human disturbance from recreational use of roads, trails, campgrounds, and shoreline habitat can also adversely affect the use of an area for nesting or foraging. Riparian standards, with emphasis on low levels of disturbance and maintenance of mature forests, will minimize potential adverse effects of vegetation management. Road building activities along riverine and lake habitat most suitable to ivory-billed woodpecker will be minimal. Currently, it is believed that this species does not occur on the Forests; however, there is limited potential habitat for this species on the St. Francis NF. If the species is documented on the St. Francis NF, the Forest Service will immediately consult with the USFWS. Further review of projects in the area will need to occur to determine appropriate conservation measures. The possibility of the ivory-billed woodpecker on the St. Francis NF is very remote.

Since this species is not known to occur on the OSFNFs and is separated from the Big Woods Corridor, forest management activities will have no effect on this species.

Cumulative Effects

When impacts of actions proposed in any of the alternatives is combined with other proposed activities and future management of the area on both public and private lands, there would be a positive cumulative impact with the implementation of any alternative addressed in this document.

Bald Eagle (*Haliaeetus leucocephalus*) - Threatened

Affected Environment

The breeding habitat for the bald eagle most commonly includes areas close to coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources including fish and waterfowl. In some areas, this species prefers roosts in conifers or other sheltered sites in winter and typically selects the larger, more accessible trees. Perching in deciduous and coniferous trees is equally common in other areas. Communal roost sites used by two or more eagles are common, and 100 or more eagles may use some during periods of high use. Winter roost sites vary in their proximity to food resources and may be determined to some extent by a preference for a warmer microclimate at these sites. Available data indicate that energy conservation may or may not be an important factor in roost-site selection.

On the Forests, potential breeding habitat would be about 2,000 acres and includes forested edges of permanent open water areas of lakes, rivers, and perennial streams along with cypress/tupelo swamps in the Mississippi floodplain of the St. Francis NF. Potential wintering habitat is about 60,000 acres and is derived from buffering stream corridors, permanent open water areas, known communal roosts, and cypress/tupelo swamps.

The bald eagle is listed as a threatened species and is typically transitory in this area of Arkansas. There is one known active nest site on the Forests, but there are three other active nests that are within the boundary of the Forests but are on private tracts that are very close to forest service land. The Arkansas Game and Fish Commission (AGFC) and USFS check the nests annually. According to the annual eagle survey conducted by the AGFC in cooperation with the USFWS, U. S. Army Corps of Engineers, National Wildlife Federation (NWF), and USFS, wintering populations within the state have steadily increased to over 1,000 birds. In 1995, 18 pairs of bald eagles successfully fledged young from the nest. Nationwide, numbers have continued to climb over the years.

Several roost sites occur scattered over the Forests and are usually associated with lakes or rivers. Being shot by poachers is the most important recognizable threat to the bald eagle in Arkansas at this time, although there is concern of avian diseases with past die-offs occurring on Lake Ouachita and Lake DeGray.

Direct and Indirect Effects

Vegetation management, road building, and prescribed burning activities could have the potential to affect the bald eagle or its habitat, especially near rivers, lakes, or other wetlands. Implementation of forest-wide standards will reduce the risk of harm. Human disturbance from recreational use of roads, trails, campgrounds, and shoreline habitat will continue. Forest-wide standards for management around riparian habitats emphasize low levels of disturbance along streams and maintenance of mature forests. This will minimize potential adverse effects of vegetation management, road building, and prescribed burning activities along riverine and lake habitat most suitable to bald eagles.

Prescribed burning standards prevent burning with wind directions that will affect bald eagle nests on or near the Forests. Standards also minimize disturbance to roost sites caused by prescribed fire. Forest management activities that take place well away from nest and communal roost areas and are well removed from large rivers, impoundments, and other significant foraging areas have little or no effect on transient wintering bald eagles. Following forest-wide standards, a 1,500-foot radius protection zone will be established around any bald eagle nest or communal roost site found on the Forests. Within this protection zone, vegetation management or other activities that will affect the forest canopy or may disturb eagles, will be prohibited during periods of eagle use (seasonal).

Because of forest-wide standards for the protection of nesting and communal roost sites as well as the protection around riparian habitats, minor disturbance of this species may occur but most management actions will not directly affect this species. There may be indirect effects from recreational use of lakes and rivers or from the noise of off-highway vehicle use.

Cumulative Effects

Forested habitat along rivers, lakes, and wetlands will continue to be good. Activities on private lands will continue to influence the species. When impacts of implementation of any alternative addressed here are combined with impacts from adjacent private lands, there will be no cumulative effects on this species. Potential adverse actions taken on adjacent private lands would likely continue however. If nesting of bald eagles is documented on the Forests, implementation of forest-wide standards requiring a 1,500-foot protection zone around these sites during the active nesting season will provide for the protection of this species.

Because the Forests will implement forest-wide standards for the protection of eagle nesting and communal roost sites as well as the protection of riparian areas, there is only a remote possibility that proposed management will adversely affect this species. There is, however, still the possibility that the species could be disturbed by noise or recreational use around lakes and streams on the Forests. Based on the factors, the bald eagle is given the status of “Not Likely to Adversely Affect.”

Bachman's Sparrow (*Aimophila aestivalis*) - Regional Forester's Sensitive

Affected Environment

Historically, this species has been found in mature to old growth southern pine woodland that has been subjected to frequent growing-season fires. It is a fugitive species, breeding wherever fires created suitable conditions. This species requires a well-developed grass and herb layer with limited shrub and hardwood midstory components. Ideal habitat was originally the extensive longleaf pine woodlands of the south. It was able to colonize clearcuts and early seral stages of old field succession but such habitat remained suitable only for a short time.

Habitats for this species include dry open pine (southern states) or oak woods (e.g., western portion of range) with an undercover of grasses and shrubs, hillsides with patchy brushy areas, overgrown fields with thickets and brambles, grassy orchards, and large clear-cuts. In the southeastern U.S., Coastal Plain breeding habitat usually is open pine woods with thick cover of grasses or saw palmetto; in the Piedmont, mainly in overgrown fields with scattered saplings, occasionally in open woods with thick grass cover (Hamel 1992).

In Arkansas, this species ranges across the southern half of the state up to the southern one-half of the Forests. This species historically has been found in Baxter, Conway, Franklin, Johnson, Logan, Newton Pope, and Van Buren Counties in Arkansas. Good or ideal habitat is limited on the Forests to areas where timber management has taken place in the recent past.

Primary threats to this species include:

- Habitat loss caused by the conversion of longleaf pine stands to plantations of fast-growing pines, a shortage of newly abandoned farmland, and urbanization,
- Negative effects caused by fire suppression that increase understory and its shrubby components, and by harvest rotations that maintain unsuitable timber age classes (i.e. 15-70 years old),
- Parasitism by brown-headed cowbirds, and
- Predation of nestlings and eggs eaten by snakes or mammals.

Direct and Indirect Effects

There would be improved habitat for this species with all alternatives addressed in this document, which would result in beneficial effects to this species. The increase of early seral habitat provided by timber harvest treatments and prescribed burning along with woodland and old growth restoration will provide needed habitat in areas where this habitat is now limited. Cowbird parasitism would not change. There may be an increase in the number of predators in areas where treatments occur, however, the loss of individuals to predators will be small compared to the potential population gains that occur following habitat improvement. Individual projects on the

Forests may impact individuals, but overall forest management activities are not likely to cause a trend to federal listing or a loss of viability for this species.

Cumulative Effects

The continued loss of habitat as conversion to non-forested land uses and urbanization on private lands is likely to continue. Gains in habitat made on the Forests through management practices may offset some of the losses made elsewhere. When impacts of actions proposed in any of the alternatives is combined with other proposed activities and future management of the area on both public and private lands, there would be a positive cumulative impact with the implementation of any alternative addressed in this document.

BATS

Gray Bat (*Myotis grisescens*) - Endangered

Affected Environment

Gray bat colonies are restricted entirely to caves or cave-like habitats. During summer, the bats are highly selective for caves providing specific temperature and roost conditions. Usually these caves are all located within a kilometer of a river or reservoir. In winter, they utilize only deep, vertical caves having a temperature of 6 to 11 degrees Celsius (°C). Consequently, only a small proportion of the caves in any area is or can be used regularly.

One-way migrating distance between winter and summer caves may vary from as little as 10 miles to well over 200 miles. Banding studies indicate the bats occupy a rather definite summer range with relation to the roosting site and nearby foraging areas over large streams and reservoirs. Summer colonies show a preference for caves not over 1.2 miles from the feeding area.

The range of the endangered gray bat is concentrated in the cave regions of Alabama, Arkansas, Kentucky, Missouri, and Tennessee with occasional colonies and individuals found in adjacent states. Presently, the species' total population is estimated at over 2,500,000; however, about 95 percent hibernate in only 17 caves with 5 in Tennessee, 5 in Arkansas, 4 in Missouri 2 in Kentucky, and 1 in Alabama. Although gray bat numbers are still relatively high, their total population decreased significantly prior to protection resulting from being listed as federally endangered. In Arkansas, this species has been noted from Independence County north and west into eastern Oklahoma. Winter hibernacula are scattered over the north portion of Arkansas, but the largest known hibernacula are on the Sylamore Ranger District where several hundred thousand bats gather in caves to spend the winter. The population appears to be relatively stable, or possibly increasing (AGFC Annual Report, 2002-2003).

Summer roost sites are more scattered and can vary from one year to the next. The gray bat can occur on any Ozark NF district with the possible exception of the Mt.

Magazine Ranger District, which is south of the Arkansas River. This bat has not been noted on the St. Francis NF as roost or wintering habitat does not occur there. No critical habitat has been identified in Arkansas for this species.

Human disturbance and vandalism may have been primarily responsible for the decline. Disturbance of a maternity colony may cause thousands of young to be dropped to the cave floor where they perish. Excessive disturbance may cause a colony to completely abandon a cave. Other factors that have contributed to the decline include pesticide poisoning, natural calamities such as flooding and cave-ins, and possibly a reduction in insect prey over streams that have been degraded through excessive pollution and siltation. Improper cave gating and cave commercialization have also contributed to some population declines.

Direct and Indirect Effects

Forest-wide standards would protect all existing gray bat caves. It would also protect newly discovered caves as well as those potentially acquired in the future. Hibernacula and summer roost sites are protected by the implementation of forest-wide standards, which will maintain vegetation buffers of 200 feet around all caves. It will also require, if necessary, the installation of gates or barriers on roads into areas where caves and karst features occur. This will prevent disturbance of all caves occupied by populations of any threatened or endangered bats or other rare species. Until a newly discovered cave has been surveyed for bats, it is assumed that federally listed bats are present, and the cave and surrounding habitat are maintained for them until surveyed.

Effects on foraging habitat are expected to be beneficial since riparian corridors will be managed for the benefit of aquatic/riparian resources. The Forests have allocated 11,484 acres of riparian corridor along all perennial streams. These acres will be managed under Management Area 3.I (Riparian Corridors) under all alternatives. The objective of this prescription is to retain, restore, or enhance ecological processes and functions of these systems. These standards will not only provide forest cover for bat foraging and protection from predation, but will also ensure high water quality to support the aquatic insect prey base.

Cumulative Effects

There are expected to be no cumulative effects to the gray bat resulting from implementation of any alternative. As stated above, the caves where this species occurs are to be protected on the Forests. Riparian vegetative conditions will be maintained based on standards associated with the Management Area 3.I. Insect populations (especially mayflies and other aquatic insects) will continue to be maintained so foraging will not be affected.

Indiana Myotis (*Myotis sodalist*) - Endangered

Affected Environment

The Indiana bat was listed as endangered under provisions of the Endangered Species Act (ESA) on March 11, 1967. The USFWS developed a Recovery Plan dated October 14, 1983. This range-wide recovery plan outlines distributional and life history information along with management recommendations and recovery objectives. In October 1996, the Indiana Bat Recovery Team released a Technical Draft Indiana Bat Recovery Plan with a final revised plan due later.

The Indiana bat currently ranges from several Midwestern states to the mid-Appalachians. It formerly extended north to the New England states of Massachusetts, New York, and Vermont. Its greatest population concentration occurs in Indiana, Kentucky, and Missouri. In Arkansas, approximately 2,200 Indiana bats are found in only 10 caves scattered over the north and western part of the state. This species has been recorded in Franklin, Izard, Newton, Stone, and Washington Counties in Arkansas. The USFWS identify no critical habitat found in Arkansas.

Less than one percent of the caves and mines within the range of the species offer suitable hibernating conditions. Indiana bats hibernate in characteristic dense clusters in particular sections of certain caves and usually return annually to the same places in the same caves. They emerge in late March to early April and disperse to summer habitat.

Available information on summer habitats suggest they disperse to roost, forage, and bear young in riparian as well as upland sites. It is likely that female Indiana bats from Arkansas hibernacula migrate northward to maternity roost sites located to the north of the Ozark Mountains.

Summer habitat was initially considered to be floodplain and riparian forest. More recently, studies have shown upland forest to be used by Indiana bats for roosting and upland forest, old fields, and pastures with scattered trees have been shown to provide foraging habitat. Indiana bats live in highly altered landscapes and use an ephemeral resource (dead and dying trees) as roost sites. Historically, at least in the western part of the species' range, the Indiana bat may have been a savanna species. The following facts support this contention: they prefer large trees in the open or on edges, they seem to prefer open canopies and fragmented forest landscapes, and they seem to prefer forest with open understory (Indiana Bat Revised Recovery Plan 1999). Within the range of the species, the existence of the bat in a particular area may be governed by the availability of natural roost structures, primarily standing dead trees with loose bark. They also utilize shagbark hickory, white oak, and other "loose bark" species as roost trees.

They emerge at night to forage on moths, beetles, and other insects in upland sites, over ponds as well as over tree-lined streams and adjacent woods. Young are born in June and are capable of full flight in approximately 30 days.

The bats return to the cave used for hibernation between August and October for breeding and feeding in preparation for hibernation. Hibernacula site fidelity is high, with most individuals returning to the same cave, even the same spot within the cave, year after year.

On the Forests, eight known caves serve, or have served historically, as hibernacula for Indiana bats. The entire Forests provides potential suitable habitat.

Summer roosting habitat is very good over much of the Forests' forested acres in mid-to-late seral condition. Trees and snags 9" dbh or greater, which will provide critical roosting habitat, are common.
Historical causes of population decline in the Indiana bat are mainly the result of human activities. Because the Indiana bat migrates between a summer and winter range, it is faced with threats specific to each area. During the winter, human disturbance to hibernating bats has been a primary cause of decline. The installation of gates at some cave entrances also caused population declines by altering temperatures and humidity within the cave, or making the cave inaccessible to the bats. In addition, as reservoirs were created, some caves were lost to flooding. Historically, stream channelization, deforestation, and agricultural development have threatened Indiana bats in their summer range. Populations of Indiana bats have been declining since the 1970s.

Current Threats

Winter Range

- **Disturbance of Hibernating Bats** - During the winter, Indiana bats enter a state of hibernation and do not feed. Fat reserves stored prior to hibernation are limited and are only enough to sustain the bats until spring. When Indiana bats are disturbed while hibernating, they become aroused and can use up 10-30 days of stored fat.
- **Cave Degradation** - Slight or moderate changes in a cave's environment can cause the cave to become uninhabited or inaccessible. Improper installation of cave gates can cause temperatures to change, disrupt airflow, alter lighting, or block the cave's entrance. Caves used for commercial purposes disrupt natural processes and may cause bats to abandon the cave and seek shelter in less suitable locations.

Summer Range

- **Habitat Modification** - Changes in habitat resulting from stream channelization, bank modification, agricultural development, and conversion of forested land have affected the amount and quality of bat habitat. Bats need wooded riparian areas for foraging, roosting, and breeding.

- **Loss of Suitable Roosting Trees** - Indiana bats raise young and roost under the bark of trees in riparian and upland forests. Harvesting trees and removing dead trees reduces the amount of available habitat and forces the bats to utilize areas where the potential for disturbance or predation may be higher.
- **Pesticides and Pollution** - Indiana bats spend the summer in agricultural areas and are potentially at risk to pesticide contamination. Indiana bats, like many other North American bats, are insectivorous. Contamination of waterways that eliminates aquatic insects may hurt local populations of Indiana bats.

Direct and Indirect Effects

Forest-wide standards for the protection of caves, karst habitats, and riparian areas will help protect needed hibernacula sites as well as potential foraging sites for this species.

Pond/waterhole construction will increase the number of upland water sources available for this bat species. Persistence of early-successional habitats and forests with an open understory and patchy overstory would create insect-rich foraging areas and flight corridors leading to any potential roost trees. Decreasing canopy closure that occurs with timber harvest and prescribed fire activities will increase the degree of exposure of some potential maternity roost trees to solar radiation, providing improved thermal conditions for raising young during a wide range of weather conditions.

Harvesting would produce a mosaic of regeneration areas intermixed with mature and late-successional forests. Likewise, prescribed fire would also create a mosaic of forest successional stages from early to late resulting from varying fire intensities associated with topographic features, vegetative types, and fuel accumulations. This will indirectly provide feeding areas since bats are known to forage within the canopy openings of upland forests; over ponds and clearings with early-successional vegetation, and even along the borders of pastures, or wooded strips (fence rows), and over ponds. The likelihood of harming a bat during timber harvest is extremely small, if not non-existent, under all alternatives with the implementation of forest-wide standards. This is due to the limited occurrence of Indiana bats on the Forests when compared to the number of acres, standing trees, snags, and that the use of any individual dead tree as a roost is likely to be brief.

Although there is a risk of harming individuals by timber harvest or other vegetation management, the risk of direct effects to roosts in the vicinity of hibernacula is further minimized because the implementation of forest-wide standards, which provide protective buffers around these sites. Most types of timber harvest (salvage, even-aged, uneven-aged, etc.) activities would require some snag and potential roost tree retention plus specific retention of some leave trees that display exfoliating bark.

Prescribed burning would have the highest number of acres to be treated in Alternative C, and, consequently, the most fire line, followed by Alternatives E, D, A,

and B in order. Impacts of prescribed burning will be reduced by following forest-wide standards that call for burn plans written for areas with caves or mines to identify these sites as smoke-sensitive targets and to avoid active combustion and smoldering phase smoke from entering these sites when bats are present.

Although very remote, there is a possibility that Indiana bats could be harmed by existing external or internal cave gates as individuals have been known to run into these structures. However, the harm here is offset because gates will reduce the possibility of human disturbance, which is a major factor in past population declines.

Commercial use of Blanchard Springs Caverns will continue with tours going through the upper level and a portion of the middle levels of the cave. Year-round tours on the upper level do not disturb Indiana bats, as they have never been found there. Hibernating Indiana bats are very rare in the middle level of the cave, but they have been found in undeveloped portions of that level. Because tours use that area of the cave only during summer months, this recreational use will have no direct effect on this species.

Management of primary and secondary Indiana bat zones will restore quality foraging and roosting tree habitat in close proximity to known hibernacula.

Cumulative Effects

With implementation of any alternative and potential cumulative effects, the Forests will maintain an abundant supply of snags, live potential roost trees, upland water sources, and other habitat features across the landscape to allow maintenance and to promote the recovery of Indiana bat populations. At the same time, activities can continue to meet other multiple-use objectives.

Overall, there will be both benefits and impacts to the Indiana bat from management activities on the Forests. The most prominent benefits are as follows:

- Retention of some snags, shag-bark hickory, and hollow trees in sale areas would allow potential Indiana bat roost sites to be conserved;
- Opening up of the canopy in sale areas and their margins would increase the degree of exposure of some potential maternity roost trees to solar radiation, providing improved thermal conditions for raising young; and
- Pond construction would increase the number of upland water sources available for Indiana bat.

Slightly positive benefits for Indiana bat would result as harvested units create insect-rich foraging areas and flight corridors leading to any tree roosts that might be present there. Positive benefits would result from prescribed burning by decreasing understory vegetation density. Positive benefits will also be realized from the application of prescriptions and associated standards focused on protecting caves and managing vegetation structure and condition within a 5-mile conservation zone of hibernacula. In addition, implementation of Forest-wide standards will protect caves and associated karst as well as riparian zone protection.

The major negative impacts to the Indiana bat would be:

- The slight chance that individuals or small groups of roosting bats (including summer maternity colonies) could be unintentionally killed by the intentional felling of trees harboring undetected roosts (e.g., dead limbs with loose bark, or small cavities in the boles) by the accidental felling of occupied snags, damaged, or hollow trees during timber harvest or other activities; and
- A short-term reduction in the total amount of foraging habitat available to individual Indiana bat, which would be incurred on regeneration cuts.

Although these bats will use small forest openings and edges as foraging habitat, they would be unlikely to utilize the central portions of larger harvested units during the early years of regeneration unless the residual basal area were unusually high. It is possible that the increased rate of insect production in areas regenerated would make up for any loss of foraging habitat acreage.

Although the likelihood is very low, implementation of any alternative may result in the inadvertent loss of individual Indiana bats or small groups of Indiana bats, via removal of some large-diameter hardwood trees occupied by bats. This risk would be greatest in those alternatives with the highest acres of timber harvest. Alternative D has the highest acres estimated, followed by Alternatives B, A, C, and E, in order. Under all alternatives, forest-wide and management area standards will provide adequate protection for summering and transitory Indiana bat individuals. This will provide for maintenance of extensive forest areas that would remain undisturbed by most human processes that result from tree cutting. These areas are characterized by disturbance events where net losses and gains of potential roost trees would be dependent on ecological processes including tree mortality due to aging, insects and disease, lightning-caused fires, and weather events. There is the remote potential for individuals to be impacted during timber harvest. However, the overall increased amount of improved roosting and foraging habitat for the Indiana bat through management activities along with other potential cumulative actions in the past or future suggest that these potential losses would be offset by overall future net gains in the population under all alternatives.

There is little likelihood that implementation of management activities with any alternative addressed in this document would cumulatively affect this species when combined with other effects from past, present, and future activities on both public and private lands. As human populations increase over time, negative impacts to this species and its habitat are likely to occur. Implementation of forest-wide standards will help to reduce these negative impacts on this species.

When considering management activities with each of the alternatives addressed here, implementation of any of the alternatives are not likely to adversely affect the Indiana bat.

Ozark Big-Eared Bat (*Corynorhinus townsendii ingens*) - Endangered

Affected Environment

The Ozark big-eared bat is generally associated with caves, cliffs, and rock ledges in well-drained, oak-hickory forests. Maternity caves and hibernacula occur in a number of different surroundings ranging from large continuous blocks of forest to smaller forest tracts interspersed with open areas. Clark (1993) found that adult female Ozark big-eared bats from maternity colonies preferred to forage along woodland edges. By foraging along woodland edges, the bat benefits from a less cluttered environment with cover nearby and prey densities high.

The Ozark big-eared bat is now found in western and north central Arkansas as well as eastern Oklahoma. The total population of this species is estimated to be from 1,300 to 2,000 individuals with most found in Oklahoma. Only six caves in Arkansas are presently known to be regularly inhabited by colonies of Ozark big-eared bats; a hibernation cave and two nearby maternity caves in north central Arkansas, and a hibernation cave and two maternity caves and in the northwestern part of the state. Based on summer estimates, the Arkansas population numbers approximately 550 individuals (AGFC Annual Report 2002-2003). This species has been reported from the Boston Mountain Ranger District in several locations and potentially may be found on other districts as well. It is found in Crawford, Franklin, Marion, and Washington Counties in Arkansas.

The Ozark big-eared bat was listed as endangered because of the small population size, reduced distribution, and vulnerability to human disturbance. Habitat loss and increased human disturbance at maternity caves and hibernacula are likely causes of the species' decline. Predation, reduced food supply, and disease may have some effect, but human disturbance at maternity and hibernation sites remains the major concern.

Direct and Indirect Effects

Under all alternatives, forest-wide standards and requirements established by the implementation of the terms and conditions of the Biological Opinion would protect all caves that are discovered or purchased that support this species. In addition, management that encourages small canopy openings and an open midstory is beneficial to this species. Timber harvest treatments proposed in all alternatives will enhance foraging habitat for this species.

Implementation of forest-wide standards will ensure that unique sites will be protected and wind direction considered prior to starting firing activities. All caves will be protected and those that provide roosting sites for this species will have additional protection measures applied by the implementation of various forest-wide standards.

Management activities that open up the overstory and provide more open habitat conditions will provide better foraging opportunities for this species. Forest-wide standards that call for at least two permanent water sources per square mile will also be of benefit to this species.

Because foraging habitats will be improved under all alternatives and because forest-wide standards will require protection of caves and karst sites, actions in these alternatives are not likely to adversely affect this species. Because habitat will be improved with all alternatives and because cave habitats are protected, there would be a beneficial effect on this species.

Cumulative Effects

The Ozark big-eared bat was listed as endangered because of the small population size, reduced distribution, and vulnerability to human disturbance. Habitat loss and increased human disturbance at maternity caves and hibernacula are likely causes of this species' decline. Management activities that open up the overstory and provide more open habitat conditions will provide better foraging opportunities for this species.

Most of the known site locations for this species are from eastern Oklahoma into western and north central Arkansas (where it has been found both on and off the forests). There is little likelihood that implementation of management actions called for with any alternative addressed in this document would cumulatively effect this species when combined with other impacts from past, present and future activities on both public and private lands. As human populations increase over time, negative impacts to this species and its habitat have the potential to occur. Implementation of forest-wide standards will help to reduce these negative impacts on this species

Eastern Small-footed Bat (*Myotis leibii*) - Regional Forester's Sensitive

Affected Environment

This species ranges from eastern Canada, south to Georgia and west to Oklahoma. Hibernating in caves or mines, they are the "hardiest" of U.S. cave bats. In Arkansas, it is known in small numbers from only a few caves in the Ozarks. It has been in Newton and Stone Counties, and more recently during surveys conducted in Franklin County. They are one of the last to enter caves in autumn and often hibernate near cave or mine entrances where temperatures drop below freezing and where humidity is relatively low.

Habitat is mostly hilly or mountainous areas, in or near deciduous or evergreen forests, sometimes in mostly open farmland. During summer months, they often inhabit buildings and caves and emerge to forage shortly after sunset and fly slowly and erratically, usually 1 to 3 meters (3 to 10 feet) above the ground. Apparently, these bats fill their stomachs within an hour after beginning to forage in the evening. They consume flies, mosquitoes, true bugs, beetles, ants, and other insects.

Threats to this species include:

- Closure or collapse of caves and mines, which may kill bats outright or, more significantly, alter cave microhabitat enough to make them unsuitable,
- Improper gating of caves to protect bats that may result in site abandonment,
- Alteration of riparian habitats, and
- Human disturbance during hibernation.

Direct and Indirect Effects

Forest-wide standards for the protection of caves and karst habitats as well as riparian areas will help protect needed hibernacula sites as well as potential foraging sites for this species.

Pond/waterhole construction will increase the number of upland water sources available for this bat species. Persistence of early-successional habitats and forests with an open understory and patchy overstory would create insect-rich foraging areas and flight corridors leading to any potential roost trees. Harvesting would produce a mosaic of regeneration areas intermixed with mature and late-successional forests. Likewise, prescribed fire would also create a mosaic of forest successional stages from early to late resulting from varying fire intensities associated with topographic features, vegetative types, and fuel accumulations. This will indirectly provide feeding areas since bats are known to forage within the canopy openings of upland forests; over ponds and clearings with early-successional vegetation, and even along the borders of pastures, or wooded strips (fence rows), and over ponds. Although there is a risk of harming individuals by timber harvest or other vegetation management, the risk of direct effects to roosts in the vicinity of hibernacula is further minimized because the implementation of forest-wide standards that provide protective buffers around these sites. Most types of timber harvest (salvage, even-aged, uneven-aged, etc.) activities would require some snag and potential roost tree retention plus specific retention of leave trees such as shagbark hickories.

Impacts of prescribed burning will be reduced by following forest-wide standards, which call for burn plans written for areas with caves or mines to identify these sites as smoke-sensitive targets and to avoid active combustion and smoldering phase smoke from entering these sites when bats are present.

When considering management actions called for with each of the alternatives addressed here, they may impact individuals but are not likely to cause a trend to federal listing or a loss of viability.

Cumulative Effects

Given the large number of known site locations of this species over a relatively large area, there is little likelihood that implementation of management actions called for with any alternative addressed in this document would cumulatively impact this species when combined with other impacts from past, present and future activities

on both public and private lands. As human populations increase over time, negative impacts to this species and its habitat are likely to occur. Implementation of forest-wide standards will help to reduce these negative impacts on this species.

SPECIES VIABILITY

TERRESTRIAL SPECIES

The National Forest Management Act of 1976 (NFMA) requires forest plans to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." To implement this mandate, 1982 NFMA regulations require that "fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR 219.19). The planning area is defined as Forest Service lands included under a forest plan. Additional direction (USDA Regulation 9500-4) extends this mandate to include vascular plants.

To meet these requirements during this plan revision, a two-pronged approach was used. The first prong is focused on ecological systems. Ecological systems or "communities" were identified, defined, and considered. Factors key to sustaining these systems were identified and analyzed, and have driven development of related plan direction. Effects of alternatives on these key factors are disclosed under the "Major Forest Communities" and "Rare and Special Communities" sections of this FEIS. The objective of this part of the planning process is to provide for healthy, diverse and well-distributed ecological systems across the national forest under the assumption that resulting conditions will provide for viability of the great majority of existing species.

The second prong is focused on those individual species that are most at risk of losing viability. Results of this part of the process are presented in this section. Steps included are:

- Identification of species in the planning area for which there may be risks of well-distributed populations not being maintained, with the understanding that some species are naturally rare or not well distributed.
- Identification of habitat needs and other limiting factors for each species, and the role of the OSFNFs in providing for conservation of the species.
- Grouping species based on common habitat needs, limiting factors and/or threats for efficiency in planning; at the same time, identifying species with unique needs that should be addressed individually.
- Developing any plan direction needed to address species and species group viability, in addition to that already in place for ecological systems.
- Assessing outcomes for factors under national forest management control, by alternative, for species and species groups.
- Assessing overall risk to species viability, considering factors outside of national forest management control.

Identification of species of viability concern started with those listed in the Ozark-Ouachita Highlands Assessment (OOHA). This list includes Threatened and Endangered Species, Regional Forester's Sensitive Species, rare species within the state, and birds of concern from multiple sources including Arkansas Natural Heritage, The Nature Conservancy, and species of concern lists for Partners in Flight (PIF) and U.S. Fish and Wildlife Service (USFWS).

These lists were sent to species experts within the scientific community for evaluation. Working meetings with experts were held to refine these lists. Some additional species were added. If it was determined that a species was not of viability concern on the Ozark or St. Francis National Forests, the reason was documented and it was dropped from further analysis. Ninety-three (93) species were identified for analysis (Appendix D, Table D-1).

For all species brought forward for analysis, teams of experts identified habitat needs and weighted their importance to the species. Weights indicated if community types, successional stages, or other habitat components were essential for the species (obligate), optimal for the species, or suitable for the species. Management biologists and researchers completed the evaluation using peer-reviewed scientific literature, expert opinion, and panel consensus. Additional information focusing on which factors are most limiting to species populations and the role of the national forests in contributing to range-wide and regional conservation of the species was also compiled. All species information was housed in a relational database, along with ecological systems information, to facilitate analysis.

Based on information compiled in the previous step, species were grouped into 22 groups for efficiency of consideration (Tables 3-80 and Appendix D). In the Draft EIS, these groups were presented as "Habitat Communities and Elements." Here, we have modified these habitat groups and more explicitly identified them as species groups to reinforce the concept that this part of the process is driven by species needs. In addition, some species were addressed individually.

Plan direction (desired condition statements, objectives, standards, or monitoring elements) was developed to address needs of species and species groups. Because this direction is needed to meet viability requirements, in many cases it is incorporated into all alternatives. However, in some cases needs are met at varying levels across alternatives, typically where needs are tied to major forest communities. It is with these cases where multiple-use trade-offs come into play. To assess effects of alternatives on species and species groups, key factors and indicators are identified and analyzed as used for major forest communities. In some cases, major forest community indicators serve well to indicate effects to a species group. Where this is the case, those indicators are repeated here. In other cases, new indicators are identified and analyzed. Following the process used for communities, benchmarks for indicators were set to represent "poor," "fair," "good," and "very good" conditions relative to sustaining viability of species (Table 3-81). In evaluating results of this analysis, special attention is given to those indicators that fall into the "fair" and "poor" ranges to identify unavoidable limitations or multiple-use trade-offs that serve to constrain these outcomes.

Finally, to be sure that all factors were considered, a species-by-species review was conducted. Agency biologists have assigned an overall rating of viability risk to each species that incorporates limiting factors both within and outside agency control (Appendix D, Table D-2).

Table 3-80: Species Groups Used in Viability Evaluation for Forest Plan Revision on the Ozark (Oz) and St. Francis (SF) National Forests.

Species Group	Oz	SF	Species Group Description
Glade and Barrens Associates	x		Species associated with Glade and Barrens Community
Cliff and Talus Associates	x		Species associated with Cliff and Talus Community
Montane Oak Forest Associates	x		Species associated with Montane Oak Forest Community
Canebrake Associates	x	x	Species associated with Canebrake Community
Seeps and Fens Associates	x		Species associated with Seeps and Fens Community
Pond and Emergent Wetland Associates	x	x	Species associated with Sinkhole and Depression Pond, Bottomland Depression, and Emergent Wetland Communities
River and Stream Associates	x	x	Species that are aquatic for a portion of their life history and are associated with the flowing water of rivers or streams. Does not include fully aquatic species such as fish and mussels, which are covered under the aquatic viability analysis.
Cave, Mine, and Karst Associates	x		Species associated with Cave, Mine, and Karst Community, which includes near reaches of associated springs and their riparian areas
Woodland and Grassland Associates	x		Species associated with oak and pine woodland conditions within Dry Oak Forest and Woodland and Shortleaf Pine-Oak Forest and Woodland Communities, and Native Grassland Community
Shortleaf Pine-Bluestem Grass Associates	x		Species associated with pine woodland and open-canopied pine forest conditions within the Shortleaf Pine-Oak Forest and Woodland Community
Open Oak Forest Associates	x	x	Species associated with open-canopied forest conditions within Dry Oak Forest and Woodland, Dry-Mesic Oak Forest, and Loess Slope Forest Communities
General Mature Forest Associates	x	x	Species associated with mature forest conditions across all community types
Mature Mesic Forest Associates	x	x	Species associated with mature forest conditions on mesic sites, regardless of canopy closure, across all community types

Table 3-80: Species Groups Used in Viability Evaluation for Forest Plan Revision on the Ozark (Oz) and St. Francis (SF) National Forests. (Continued)

Species Group	Oz	SF	Species Group Description
Mature Mesic Forest with Canopy Gaps Associates	x	x	Species associated with mature forests with canopy gaps on mesic sites across all community types
Mature Mesic Forest with Closed Canopy Associates	x	x	Species associated with mature closed canopied forests with closed canopies across all community types
Mature Forest in Riparian Area Associates	x	x	Species associated with mature forests in riparian areas
Dense Riparian Understory Associates	x	x	Species associated with dense understories in riparian areas, typically found with regenerating forests, mature open-canopied forests, and Canebrake Community
Mature Forest Interior Birds	x	x	Bird species associated with relatively large blocks of mature forest, and whose reproductive success may be adversely affected by the creation of forest edge
Regenerating Forest Associates	x	x	Species associated with regenerating forests across all community types
Mixed Successional Forest Associates	x	x	Species associated with landscapes include broad mixes of forest successional stages; habitat generalists
Den Tree Associates	x	x	Species associated with large hollow trees
Snag Associates	x	x	Species associated with standing dead trees
Species Sensitive to Human Disturbance	x	x	Species sensitive to disturbance or persecution as a result of human presence

Table 3-81: Benchmark Ratings Used to Assess Outcomes Relative to Providing for Species Viability for the Forest Plan Revision - Ozark and St. Francis National Forests.

Condition Classification	Definition of SVE Score Applied to Communities and Habitat Elements
Very Good	Habitat conditions are excellent; associated species' populations should remain robust and potentially even expand.
Good	Habitat conditions are acceptable; associated species' populations should remain stable.
Fair	Habitat conditions are of concern; although associated species' populations may persist for some time, they may be subject to gradual decline.
Poor	Habitat conditions are not adequate; associated species' populations may be expected to severely decline and extirpations may occur.

Glade and Barrens Associates

Effects to viability of species within this group are indicated by conditions within the Glades and Barrens rare community. Analysis of this community in the "Rare and Special Communities Section" of this document indicates that conditions within this community are currently "poor" primarily because of fire suppression and neglect. The rarity and declining status of some species associated with this community supports this rating. Due to increased prescribed fire and focus on inventory, monitoring, and maintenance of rare communities under all alternatives, ratings are expected to reach "fair" levels by the end of the first decade and "good" levels over the long term. Where habitat is believed to be a limiting factor, which is often the case for species associated with rare communities, this improvement of conditions is expected to contribute to stabilizing population trends of species in this group and allow for potential population increases under all alternatives. All alternatives would lower risk to species viability as it is affected by their association with this community.

Cliff and Talus Associates

Effects to viability of species within this group are indicated by conditions within the Cliff and Talus Rare Community. Analysis of this community in the "Rare and Special Communities Section" of this document indicates that conditions within this community are currently "good" primarily because of their low maintenance needs and relative inaccessibility, which limits opportunity for recreational impacts and unintended impacts from management activities. Increased prescribed fire and focus on inventory, monitoring, and maintenance of this rare community are expected to improve ratings to "very good" levels by the end of the first decade as well as over the long term. These results indicate that species are not likely to be put at viability risk through their association with this community under any alternative. All alternatives are expected to slightly lower risk to species viability as it is affected by their association with this community.

Montane Oak Forest Associates

Effects to viability of species within this group are indicated by conditions within the Montane Oak Forest Rare Community. Analysis of this community in the "Rare and Special Communities Section" of this document indicates that conditions within this community are currently "good" primarily because it is limited to the higher elevations of Mount Magazine, where it has received recent management attention. Increased focus on inventory, monitoring, and maintenance of this rare community are expected to improve ratings to "very good" levels by the end of the first decade as well as over the long term. These results indicate that species are not likely to be put at viability risk through their association with this community under any alternative. All alternatives are expected to slightly lower risk to species viability as it is affected by their association with this community.

Canebrake Associates

Effects to viability of species within this group are indicated by conditions within the Canebrake Rare Community. Analysis of this community in the "Rare and Special Communities Section" of this document indicates that conditions within this community are currently "poor" due to conversions to other community types over time and lack of appropriate disturbance regimes. Only Alternatives C and E include relatively small objectives for restoration of this community. Even with these objectives, these alternatives, like the others, are rated "poor" at both the 10- and 50–year time frames. Objectives are not greater under any alternative because restoration treatments are expensive and relatively unproven, other uses of riparian areas are numerous and highly valued, and importance to species viability is not critical. Only two species of viability concern are placed in this group: Swainson’s warbler and American woodcock. In addition, both are associated with other habitat conditions, including dense riparian understories of within any community type, and to a lesser extent with regenerating forests on a variety of sites. Neither of these species are obligate to this community; therefore, failure to improve the indicator status for the community is not expected to result in loss of their viability. In addition, status of this indicator is not expected to decline under any alternative when compared to current conditions, and would slightly improve under Alternatives C and E. These results indicate that species are not likely to be put at viability risk through their association with this community under any alternative.

Seeps and Fens Associates

Effects to viability of species within this group are indicated by conditions within the Seeps and Fens Rare Community. Analysis of this community in the "Rare and Special Communities Section" of this document indicates that conditions within this community are currently "fair" primarily because of lack of attention and some unintended adverse effects of management activity. Due to increased focus on inventory, monitoring, and maintenance of rare communities under all alternatives, ratings are expected to reach "good" levels by the end of the first decade and "very good" levels over the long term. Where habitat is believed to be a limiting factor, which is often the case for species associated with rare communities, this

improvement of conditions is expected to contribute to stabilizing population trends of species in this group and allow for potential population increases under all alternatives. All alternatives would lower risk to species viability as it is affected by their association with this community.

Pond and Emergent Wetland Associates

Effects to viability of species within this group are indicated by conditions within three rare and special communities combined: Sinkhole and Depression Ponds, Emergent Wetlands, and Bottomland Depressions. Analysis of these communities in the "Rare and Special Communities Section" of this document indicates that conditions within these communities are currently "good," "fair," and "very good," respectively, averaging a "good" rating (Table 3-82). All three are expected to reach "good" or "very good" levels within 10 years and to maintain these levels over the long term. This improvement is due to increased focus on inventory, monitoring, and maintenance of rare communities under all alternatives. Most of the viability concern species within this group are amphibians. Improvements for these species is expected as a result of increased attention to desired habitat conditions that surround these wetlands. Surrounding habitat is important for providing cover and movement corridors for adults that use these wetlands for breeding. Where habitat is believed to be a limiting factor, which is often the case for species associated with rare communities, this improvement of conditions is expected to contribute to stabilizing population trends of species in this group and allow for potential population increases under all alternatives. All alternatives would lower risk to species viability as it is affected by their association with this community.

Table 3-82: Average Indicator Ratings for Wetland Communities Providing Habitat for Pond and Emergent Wetland Associates by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Average indicator rating in 10 years	3.0 Good	3.67 V. Good	3.67 V. Good	3.67 V. Good	3.67 V. Good	3.67 V. Good
Average indicator rating in 50 years	3.0 Good	3.67 V. Good	3.67 V. Good	3.67 V. Good	3.67 V. Good	3.67 V. Good

Cave, Mine, and Karst Associates

This species groups includes several species of viability concern, including salamanders, bats, cave fish, and invertebrates. Effects to viability of species within this group are indicated by conditions within the Cave, Mine, and Karst Rare Community. Analysis of this community in the "Rare and Special Communities Section" of this document indicates that conditions within this community are currently "good" because most caves have been inventoried and currently receive protection. Conditions are expected to remain "good" in both the short- and long-term under all alternatives due to continued efforts to inventory and protect caves. Many species associated with caves are obligates, requiring quality cave habitats for their persistence. Because of protective measures included under all alternatives, cave, mine, and karst habitats are expected to be maintained. Because of the rarity and

sensitivity of these habitats, risk to viability of these species remains a concern, but is not expected to increase, and may improve as more inventories are completed and protective measures put into place.

Woodland and Grassland Associates

This species group includes 19 species of viability concern, making it the group with the highest number of associated species of viability concern. Included in this group are several species of grassland birds, some prairie-associated plants, the endangered American burying beetle, and the introduced Rocky Mountain elk. Species in this group are primarily or partially dependent on dense grass/forb cover, although some, like the red-headed woodpecker, are associated with very open canopy conditions.

The indicator for this group is derived from three indicators used for community analysis: 1) percent woodland within the Dry Oak Forest and Woodland Community, 2) percent woodland in the Shortleaf Pine-Oak Forest and Woodland Community, and 3) acres in Native Grassland restored. These indicators were combined into a average indicator weighted by the relative abundance of these habitats at an optimal condition (Table 3-83).

Table 3-83: Average ratings For Community Indicators Relevant to Habitat for Woodland and Grassland Associates by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Average indicator rating in 10 years	1.00 Poor	1.0 Poor	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor
Average indicator rating in 50 years	1.00 Poor	1.05 Poor	1.05 Poor	3.02 Good	1.05 Poor	3.02 Good

Average indicator ratings for this group are at a "poor" level due primarily to suppression of fire that once created and maintained these habitats. The relatively large number of species of viability concern associated with this group reflects this "poor" status. Indicators remain "poor" over the next 10 years under all alternatives, although improvements are made in each case. All alternatives include considerable effort to restore existing pastures to native grasslands achieving "very good" levels for this indicator within 50 years; Alternative C makes the quickest progress in restoring native grasslands. However, relative to woodland acreage, the effect of this restoration on overall habitat abundance for this group is relatively small. Significant effort to restore oak and pine woodland is primarily limited to Alternatives C and E, which include objectives sufficient to reach "good" levels within 50 years; the other alternatives include only minimal woodland restoration resulting in these indicators remaining at "poor" status. This effort results in these two alternatives eventually reaching overall "good" status for this group.

In balance, risk to viability of species within this group is expected to be substantially improved under Alternatives C and E due to large efforts to restore native grasslands and oak and pine woodlands. Under the other alternatives, restoration of native

grasslands would improve risk to some extent, but lack of substantial woodland restoration would mean that many of these species would still be limited to habitats that are far below historical distribution and abundance, resulting in continued high levels of risk.

Shortleaf Pine-Bluestem Grass Associates

The indicator for this species group is the average rating of two indicators used for analysis of the Shortleaf Pine-Oak Forest and Woodland Community: 1) percent of woodland, and 2) percent of older forests with open canopies. Currently, conditions for both of these indicators are rated "poor" (Table 3-84). The indicator remains "poor" under all alternatives in the short-term, but improves to "good" over the long-term under Alternatives A and C, and reaches "very good" under Alternative E. Alternative A shows improvement over the long-term because of higher levels of pine thinning. Alternatives C and E improve in this indicator because they both include pine woodland restoration objectives. Other alternatives remain at "fair" to "poor" conditions because they do not include woodland restoration objectives.

Table 3-84: Average Ratings for Community Indicators Relevant to Habitat for Shortleaf Pine-Bluestem Grass Associates by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Average indicator rating in 10 years	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor
Average indicator rating in 50 years	1.00 Poor	2.50 Good	1.50 Fair	3.00 Good	1.00 Poor	3.50 V. Good

In balance, Alternatives A, C, and E are expected to provide substantially decreased risk to species as a result of their association with this habitat where this habitat is limiting. Only Alternative D does not improve at least one of these indicators. It and Alternative B are expected to result in both indicators being below the "good" benchmark, resulting in higher levels of risk to viability of associated species where this habitat is limiting.

Open Oak Forest Associates

The indicator for this species group is the weighted average rating of three indicators used for analysis of "Major Forest Communities": 1) percent of older forests with open canopies in the Dry Oak Forest and Woodland, 2) percent of older forests with open canopies in the Dry-Mesic Oak Forest, and 3) percent of older forests with open canopies in the Loess Slope Forest. Currently, conditions for all three of these indicators are rated "poor" because of fire suppression and low levels of forest thinning relative to need. All indicators are expected to remain "poor" under all alternatives across all time frames due to the infeasibility under reasonably foreseeable program levels to treat the large acreages of mature closed canopy forest. Thus, weighted averages of these indicators are also "poor" across all alternatives and time frames. Also, this result generally reflects an expected greater relative program emphasis on regenerating mature forests rather than thinning them.

Only three species of viability concern are in this group: the worm-eating warbler, yellow-throated vireo, and Ozark least trillium. Although these species would benefit from open-canopied oak forests, none are limited to this habitat, also being found more generally in upland forests of a variety of mature forest structural conditions. This particular habitat condition does not appear to be limiting to any of these three species. Therefore, their viability is not likely to be put at substantial risk from the "poor" status of these indicators under any alternative.

General Mature Forest Associates

The indicator for this species group is the weighted average rating of the "percent of mature forest" indicators used in the "Major Forest Community" analysis for Dry Oak Forest and Woodland, Shortleaf Pine-Oak Forest and Woodland, Dry-Mesic Oak Forest, Loess Slope Forest, and Bottomland and Floodplain Forest. Currently, and under all alternatives and time frames, these indicators are rated "very good" because of the large percentages of forest in a mature condition. In many cases, acreage of mature forest exceeds optimal benchmarks, reflecting the aging nature of the Forests and the infeasibility of regenerating enough forest at foreseeable future program levels to achieve desired age class diversity. As a result, viability of species associated with mature forests in general are not expected to be limited by this aspect of their habitat.

Mature Mesic Forest Associates

Effects to viability of species in this group are indicated by the "percent of mature forest" indicators used in the "Major Forest Community" analysis for those forest types generally occurring on mesic sites, namely Dry-Mesic Oak Forest, Loess Slope Forest, and Bottomland and Floodplain Forest. In all cases, as with indicators for General Mature Forest Associates, conditions for these indicators are rated "very good" as a result of the large percentages of forest in a mature condition. Under all alternatives, time frames, and forest types, these indicators are expected to remain at or above "very good" levels. As a result, viability of species associated with mature forests in general are not expected to be limited by this aspect of their habitat under any alternative.

Mature Mesic Forest with Canopy Gaps Associates

Although mature mesic forests are expected to be abundant under all alternatives, not all mature forests are of equal quality as habitat for some species. Species within this group benefit from gaps in the canopy of mature mesic forest. These gaps provide small patches of dense understory and eventually greater diversity in vertical canopy structure. Abundant canopy gaps, created by mortality and treefall of large canopy trees, are typical of older or "old growth" mesic forests. In the absence of older stands exhibiting this level of mortality, canopy gaps can be created through vegetation management to the benefit of species within this group.

Effects to viability of species in this group are indicated by the weighted average ratings of indicators for "percent of older forests with open canopies or canopy gaps" used in the "Major Forest Community" analysis for Dry-Mesic Oak Forest, and Loess

Slope Forest, which provide the majority of mesic forest acreage. Currently, conditions for these two indicators are rated as "poor" as a result of many acres of mature closed canopy forests, all about the same age, but which have not yet reached an age where gaps are developing naturally (Table 3-85). The recent oak mortality event has improved habitat for this species group somewhat; however, this type of mortality event often leaves midstories undisturbed, limiting desired understory response.

Under all alternatives, models suggest these indicators would be "poor" in both the short- and long-term as a result of limited vegetation management activities designed to open canopies or create gaps. However, natural disturbance events and increased canopy tree mortality as forests continue to age may increase acreage of this habitat condition substantially above modeled results. This effect would be similar across alternatives, primarily affecting the large acreage of mature closed canopy forest. The extent of this effect is highly uncertain; therefore, no effort was made to quantitatively predict it. However, cumulatively, it is likely that this habitat condition will increase in abundance across all alternatives as a result of gap creation through natural events. Therefore, ratings under all alternatives are qualitatively adjusted to "fair" levels over the long term (Table 3-85).

Table 3-85: Average Ratings for Community Indicators Relevant to Habitat for Mature Mesic Forests with Canopy Gaps Associates by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Average indicator rating in 10 years	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor	1.00 Poor
Average indicator rating in 50 years	1.00 Poor	Fair	Fair	Fair	Fair	Fair

This group includes nine species of viability concern, six birds, and three plants. None of these species are obligate to this condition, although the cerulean warbler may come closest. This species is discussed separately under both the "Management Indicator Species" and "Migratory Bird Sections" of this document. Analysis is slightly different than that for the Major Forest Communities, focusing specifically on acreage occurring on high quality sites. Results similarly show large acreage of mature mesic forest with relatively small percentages exhibiting canopy gaps. Because habitat for this group is expected to increase in abundance over time under all alternatives as a result of unmodeled natural events, any risk associated with limitations of this habitat are expected to decrease in all cases over the long-term. Alternatives B and D do the most to reduce this risk more immediately through application of active vegetation management.

Mature Mesic Forest with Closed Canopy Associates

In contrast to the associates of mature mesic forests with canopy gaps, some species prefer the more shaded conditions found in closed-canopy mesic forests. Indicators for closed canopy conditions were not defined during analysis of "Major Forest Communities" because these conditions generally are abundant, representing the

rule rather than the exception. Abundance of these habitat conditions can be indicated by taking the abundance of mature mesic forests and subtracting the abundance of mature mesic forests with gaps. Abundance of closed-canopy mature mesic forest is expected to be high under all alternatives (Table 3-86). As canopy gaps increase over time due to both management actions and natural events, this habitat will decline somewhat in abundance, but is expected to remain common, representing "very good" conditions for associated species. In addition, even in forests with canopy gaps much of the area between gaps is still suitable for species within this group. Therefore, availability of this habitat is not expected to limit viability of any associated species.

Table 3-86: Levels of Habitat for Associates of Mature Mesic Forests with Closed Canopies by Alternative-OSFNFs.

Decade	Alternatives					
	Current	A	B	C	D	E
Acres—Decade 1	271,800	263,600	247,600	262,800	255,300	263,600
Acres—Decade 5	271,800	221,800	221,000	229,000	211,400	236,200
% of Mesic Forest that is Mature --Decade 1	84.0	81.5	76.5	81.5	78.9	81.5
% of Mesic Forest that is Mature --Decade 5	84.0	68.5	68.3	70.8	65.3	73.0

Mature Forest in Riparian Area Associates

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 often 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 help retain moisture and provide important habitat substrate for reptiles, amphibians, small mammals, invertebrates, mosses, and liverworts. Many riparian-dependent species are associated with late-successional riparian forest conditions due to the diverse structure and the moist, temperature-moderated

microclimates they provide. However, there are also species that require early-successional or shrubby riparian habitat as well as low basal area older forest conditions.

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. Important disturbance sources in riparian areas are ice storms, tornadoes, beaver activity, 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, thinned mast producing areas, and gardens (Brantley and Platt 2001). Concentration of anthropogenic disturbances in riparian habitats was the result of the high fertility and level terrain of these areas. The highest concentration of prehistoric agricultural settlements is found in floodplain settings (Lockhart et al 1995). Sabo and others (2004:32-34) estimate that Native Americans could have farmed 31 percent of the Forests. During European settlement, cleared lands increased to over 36 percent of the Forests, much of which would have been in riparian areas.

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, but effects of fire were more prominent in the uplands resulting in a variety of late, early, and fire-thinned riparian areas. The challenge for federal land managers today is to try to restore, to the extent possible, the network of mature forest riparian habitat critical to many species and to water quality, while providing some level of quality habitats for those species adapted to early-successional riparian habitats.

Habitat for this species group is a subset of that used by associates of the Mature Mesic Forest Group. It includes only those mesic forests that are in riparian areas. Effects to viability of species in this group are indicated by the percent of riparian forest that is in a mature condition. This indicator is derived from mature forest indicators used in the "Major Forest Community" analysis for those forest types generally occurring on riparian sites, namely Dry-Mesic Oak Forest, Loess Slope Forest, and Bottomland and Floodplain Forest, but also includes conditions expected for Mesic Hardwood Forests and Riparian Forests.

Because of all of the ecological values of riparian areas, benchmarks for riparian indicators are not based on the higher disturbance levels of historical reference conditions, but instead on a balance estimated to best provide for both early- and late-successional riparian associated species, as well as the integrity of stream systems. As a result, benchmarks for the percent of mature forests in riparian areas are the same as those set for the percent mature indicator for Bottomland and

Floodplain Forest (Table 3-87) because these benchmarks reflect the greater emphasis on mature forest that is desirable for riparian areas.

Table 3-87: Benchmarks for the indicator used to assess effects to the Mature Forest in Riparian Area species group, Ozark-St. Francis National Forests.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
% of Forest in Riparian Areas that is Mature	< 32	32-44	45-54	55	65

Desired conditions, objectives, and standards for the Riparian Corridors Management Area (3.I) provide common direction for management of riparian areas across all alternatives. The predominate desired condition for riparian areas is mature, relatively undisturbed forest to provide for water quality protection and habitat for this species group. However, active vegetation management is allowed to enhance riparian resources, including forest health and riparian-dependent wildlife. For the purposes of this analysis, it has been assumed that all active vegetation management modeled for Riparian Forests and Bottomland and Floodplain Forests would occur within riparian areas. It is also assumed that active vegetation management modeled for other forest communities would occur at half the rate of that expected to occur forest-wide, reflecting the lower intensity of management expected within riparian areas.

As with indicators for Mature Mesic Forest Associates, the indicator for this group is currently rated as "very good" as a result of the large percentage of these forests in a mature condition (Table 3-88). Under all alternatives and time frames, these indicators are expected to remain at or above "very good" levels. As a result, viability of species associated with mature forests in general are not expected to be limited by this aspect of their habitat under any alternative.

Table 3-88: Values and Ratings of the Indicator for Current and Expected Future Habitat Conditions for the Mature Forest in Riparian Area Associates by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Average indicator rating in 10 years	74.7 V. Good	79.1 V. Good	77.9 V. Good	80.0 V. Good	79.4 V. Good	79.1 V. Good
Average indicator rating in 50 years	74.7 V. Good	76.8 V. Good	78.5 V. Good	81.9 V. Good	80.4 V. Good	82.7 V. Good

Dense Riparian Understory Associates

Species in this group prefer or require dense understories within riparian areas. Habitat for this group generally is characterized by open or sparse canopies and dense growth of regenerating trees and shrubs. For the purpose of this analysis, it includes regenerating and young forests up to 20 years old, open forests (thinned), woodland (not expected to be common in riparian areas), 16 percent of uneven-aged forest acreage (estimate of percent with dense understory at any one time), and

canebrakes. Effects to viability of species in this group are indicated by the percent of riparian forest that fall within these successional/structural categories.

As discussed in the previous section, evidence suggests that this condition occupied a considerable proportion of riparian areas during the historical reference period, but recreating this condition is not ecologically desirable due to current concerns about water quality. Therefore, benchmarks for this indicator are not based on historical reference conditions, but instead on a balance estimated to best provide for both early- and late-successional riparian associated speces, as well as the integrity of stream systems. Based on these considerations, FS biologists defined the optimal benchmark for this indicator at 10 percent, and related benchmarks were set using percentages of this optimal used throughout this analysis for rare elements (< 1% of the Forests; Table 3-89). Because this habitat is relatively rare, species of viability concern highly dependent on this habitat (e.g., Swainson's warbler and American woodcock) would still likely be limited by habitat at this optimal level.

Table 3-89: Benchmarks for the Indicator Used to Assess Effects to the Dense Riparian Understory Species Group-OSFNFs.

Key Factor/Indicator	Poor	Fair	Good	Very Good	Optimal
% of Forest in Riparian Areas with dense understories	<7.5	7.5-8.4	8.5-9.4	9.5	10

Desired conditions, objectives, and standards for the Riparian Corridors Management Area (3.I) provide common direction for management of riparian areas across all alternatives. The predominate desired condition for riparian areas is mature forest to provide for water quality protection and wildlife habitat. However, active vegetation management is allowed to enhance riparian resources, including forest health and some riparian-dependent wildlife. As with the analysis for associates of mature forests in riparian areas, it has been assumed that all active vegetation management modeled for Riparian Forests and Bottomland and Floodplain Forests would occur within riparian areas. It is also assumed that active vegetation management modeled for other forest communities would occur at half the rate of that expected to occur forest-wide, reflecting the lower intensity of management expected within riparian areas. Under Alternative E, which is the only alternative that includes an explicit objective for providing dense understories on 10 percent of riparian forest acreage, it is assumed that active management is applied in riparian areas over the long-term to the extent needed to meet this objective.

Data on the current condition of riparian areas as defined by the Riparian Corridor Management Area (3.I) is not of high precision because this land designation was not used during implementation of the Current Forest Plan. Therefore, a high level of uncertainty is associated with estimates of the amount of forest in riparian areas with dense understories. However, using best current estimates, the indicator for this species group is currently rated "poor" as a result of relatively low levels of recent management disturbance within riparian areas (Table 3-90). Although all alternatives increase habitat for this species group only Alternative E is expected to improve the

indicator rating to "fair" due to progress in meeting the plan objective for this habitat. In the long term, only Alternatives C and D fail to reach the "good" benchmark.

Species of viability concern within this group are four bird species, two of which, Swainson's warbler and American woodcock, may be described as riparian dependent. Both species are migratory; individuals on the Forests are part of larger populations that extend far beyond forest boundaries. Because this habitat is limited even at the optimal benchmark, risk to population viability for these species remains under all alternatives, and is not separable from that posed by threats to the larger populations. All alternatives are expected to at least maintain or improve abundance of this habitat; however, increasing habitat abundance to the extent that risk is substantially lowered for these species would potentially impose risks to other species associated with mature forest in riparian areas, as well as aquatic species. For this reason, higher levels of creation of this habitat condition were not included under any alternative.

The other two species in this group, hooded warbler and white-eyed vireo, are generally more abundant and more flexible in their habitat use than the Swainson's warbler and woodcock, being also associated with canopy gaps and dense understory in all mesic forests. Therefore, risk to their viability is not likely to be driven by limitations in this habitat condition.

Table 3-90: Values and Ratings of the Indicator for Current and Expected Future Habitat Conditions for the Mature Forest in Riparian Area Species Group by Alternative-Ozark-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
% of Forests in Riparian Areas w/ Dense Understories in 10 years	6.6 Poor	7.3 Poor	7.4 Poor	6.6 Poor	7.0 Poor	8.0 Fair
% of Forest in Riparian Areas w/Dense Understories in 50 years	6.6 Poor	9.7 V. Good	9.2 Good	7.0 Poor	8.0 Fair	10.0 V.Good

Mature Forest Interior Birds

Background research relative to effects to forest interior birds are summarized under the migratory bird section of this document. This research highlights the importance of landscape context in determining the effects of forest edge.

Following the research by Robinson and others (1995) and the review by Faaborg (2003), a regional analysis of percent forest cover within 75,000-acre roving windows was conducted using remotely sensed land cover data and a geographic information system. This analysis shows almost all of the area within the proclamation boundaries of the Ozark NF to be in landscape settings with more than 70 percent forest cover; much of it is over 90 percent forest cover (Andy Peavy, unpublished

analysis). This result suggests that the Ozark NF likely supports source populations of forest birds, and that creating edge is not likely to adversely affect population stability. In contrast, none of the area within the proclamation boundaries for the St. Francis NF is within a landscape with over 70 percent forest cover. This result suggests that the St. Francis NF likely supports sink populations of forest birds. Because of its small size, this unit is likely overwhelmed by landscape level effects on the abundance of nest predators and cowbirds, a nest parasite. Considered together as a planning unit, conditions for forest interior birds are rated as "very good" as a result of the heavily forested landscape provided by the Ozark NF.

Effects of alternatives on this group will continue to be driven to a large extent by landscape context, which is not expected to change dramatically—the Ozark NF, by virtue of its own land base will remain in a heavily forested landscape, and the St. Francis NF, by virtue of its small size and surrounding land uses, will remain hostile to forest interior birds. Because of the large area of opened canopies it will produce, landscape-level restoration of woodlands has some potential for adversely affecting this group. It is unclear whether restored woodlands will support higher populations of nest predators and cowbirds that would affect forest interior birds in surrounding habitats. Because quality woodlands are relatively rare today, especially distributed across a landscape in anything approximating a native condition, more complex interactions such as this have not been well studied. Because woodland conditions are expected to be restored in larger patches with variable residual tree density and "soft" indistinct edges, one might expect them not to concentrate adverse edge effects as do more typical permanent forest openings. Regardless of their potential for adverse effects to forest interior birds, woodlands are viewed as a critical habitat component for many grassland associated birds, which also are of high conservation concern. Determining the effects of landscape-level restoration of oak woodland on forest interior birds is a research need. Ratings for Alternatives C and E, which include landscape level woodland restoration, are reduced to "good" over the long-term to reflect this uncertainty.

Regenerating Forest Associates

Habitat for this group is defined as regenerating forest (0 -10 years old) of all forest community types. To indicate effects of alternatives on this habitat, an average rating of "percent regenerating forest" indicators from the major forest community analysis was calculated, weighted by the abundance of the forest community forest-wide. Currently, habitat for this group is rated fair, because of relatively low levels of forest regeneration in hardwood forest types across the forest (Table 3-91). In both the short and long-term, only Alternative D improves the average rating to "good," as a result of its greater emphasis on regeneration to achieve balanced forest age-classes. Although other alternatives increase regeneration rates for some forest types, the overall effect for all of these alternatives is to maintain an average rating of "fair."

The nine species of viability concern within this group are all birds. Five of the nine are also included in the Woodland and Grassland Associates group. Historically, woodlands likely provided important and similar early-successional habitat for these

species, but with the disappearance of woodlands due to fire suppression regenerating forests have become their primary habitats. With substantial levels of woodland restoration under Alternatives C and E, these habitat types are expected to complement each other in support of populations of these species. Risks to viability of these species is highest for those alternatives that do not include either substantial increases in regeneration or woodland restoration, namely Alternatives A and B. Two of the remaining four species, Swainson’s warbler and white-eyed vireo, are also associated with dense understories in riparian areas, which shows mixed indicators by alternative (see analysis for Dense Riparian Understory Associates). Risks to viability for these species are highest for alternatives that do not provide for desired levels of either of these habitats over the long-term, namely Alternatives A and C. The remaining two species, ruffed grouse and chestnut-sided warbler are the most dependent on regenerating forests. Viability risk to both of these species is driven in part by them being at the edge of their ranges on the Ozark NF; however, less than desirable levels of regenerating forest increases risk to these species.

Table 3-91: Values and Ratings of the Indicator for Current and Expected Future Habitat Conditions for Regenerating Forest Species Group by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Weighted Average of Regenerating Forest Indicators in 10 years	2.26 Fair	2.29 Fair	1.68 Fair	2.01 Fair	2.94 Good	2.01 Fair
Weighted Average of Regenerating Forest Indicators in 50 years	2.26 Fair	2.29 Fair	2.27 Fair	2.41 Fair	3.26 Good	2.01 Fair

Mixed Successional Forest Associates

This species group includes habitat generalists that thrive in landscapes with a mix of successional and structural conditions. To indicate habitat conditions for this group, ratings for indicators used in the "Major Forest Community" analysis for percent mature, percent regenerating and young, and percent woodland for each forest community were combined. Ratings were averaged for each forest community and then combined into an overall average weighted by the percent of forest-wide acreage within each forest community.

This combined indicator currently averages to a "fair" status, held down by poor ratings for percent woodland and percent regenerating and young forest for several forest communities (Table 3-92). No alternative is expected to change from this average status within 10 years, but all average "good" within 50 years as a result of increased percentages of regenerating and young forests and/or woodland restoration. Because species in this group are habitat generalists, at least for part of their life history needs, habitat is generally not limiting. Nevertheless, all alternatives are expected to improve landscape diversity, improving conditions for these species.

Table 3-92: Values and Ratings of the Indicator for Current and Expected Future Habitat Conditions for the Mixed Successional Forest Species Group by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Weighted Average of Successional Forest Indicators in 10 years	2.48 Fair	2.48 Fair	2.48 Fair	2.48 Fair	2.48 Fair	2.48 Fair
Weighted Average of Successional Forest Indicators in 50 years	2.48 Fair	2.91 Good	2.71 Good	3.01 Good	3.11 Good	3.01 Good

Den Tree Associates

Den trees are trees with hollows or cavities used as cover for wildlife. Two strategies are used in the current plan and in all plan alternatives to provide sufficient den trees for species viability: 1) standards provide for protection of existing den trees, and 2) residual trees and the general aging of the Forests provide for den tree recruitment. As a result of these strategies, den tree abundance is expected to increase under all alternatives, especially over the long term. To indicate effects of alternatives on habitat for this species group, indicators used in the "Major Forest Community" analysis for percent mature and percent possible old growth were averaged, weighted by the relative abundance of each forest community type (Table 3-93).

Currently, indicators for this habitat element are at the lower margin of the "good" rating, and are expected to maintain this rating over the short term under all alternatives. In the long-term, all alternatives result in "very good" ratings due to aging of the Forests over large acreages, which is expected to produce abundant large hollow trees.

Table 3-93: Values and Ratings of the Indicator for Current and Expected Future Habitat Conditions for the Den Tree Associates Species Group by Alternative-OSFNFs.

Indicator	Alternatives					
	Current	A	B	C	D	E
Weighted Average of Den Tree Indicators in 10 years	2.50 Good	2.50 Good	2.50 Good	2.50 Good	2.50 Good	2.50 Good
Weighted Average of Den Tree Indicators in 50 years	2.50 Good	4.0 V. Good	4.0 V. Good	4.0 V. Good	4.0 V. Good	4.0 V. Good

Snag Associates

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 two to four snags per acre being a "reasonable target." Generally for most dependent wildlife, the more snags the better for associated species.

Like den trees, snags (standing dead trees) are provided for associated species through protection of existing snags and recruitment of snags through the provision of abundant old forests, which exhibit increasing rates of tree mortality as they age. Therefore, indicators for this group are the same as those used for the Den Tree Associates group.

However, mortality events such as storms and the recent insect and disease outbreaks also influence the availability of snags and downed wood. The recent episode of oak decline in the Ozark-Ouachita area has created an abundance of snags and downed wood. Table 3-94 is an analysis of 2003 plot data of Ozark NF hardwood sawtimber stands with varying levels of oak decline and reveals the following snag densities:

Table 3-94: Relationship between Oak Decline and Snag Density.

Level of Oak Decline	Snags 9-inch DBH or greater	Snags 14-inch DBH or greater	Snags Acres Affected
None	5.6/acre	1.1/acre	174,050
Moderate	20.0/acre	10.2/acre	98,900
High	39.1/acre	15.8/acre	29,779

Stands of hardwood sawtimber averaged 1.1 large snags (14+ inches dbh) per acre in non-oak decline plots; 10.2 large snags per acre in moderate decline plots; and 15.8 large snags per acre in high decline plots.

Analysis also revealed that 29,779 acres on Ozark NF were in the high oak decline stage; 98,900 acres were in the moderate oak decline stage; and 29,779 acres were not affected by oak decline at the time plots were taken. In addition, 48,273 acres had snag levels somewhere between the high and moderate levels reported above while 164,000 acres had snag levels somewhere between the "no oak decline" and "moderate levels." For this reason, current and short-term ratings are deemed to be "very good" based on the obvious qualitative assessment of forest conditions. Long-term outcomes are also rated "very good" based on the indicators used for Den Tree Associates.

Species Sensitive to Human Disturbance

Some species are put at risk from contact with people. This risk may result from disruption of normal activities, energetic costs of avoidance, persecution (e.g., killing of snakes), collection (e.g., transplanting of showy plants, commercial collection), or accidental road mortality. The best indicator of conditions for this group is open road density. Currently, open road density of the Forests is 3.6 miles per square mile, which is relatively high for wildlands. This level is qualitatively rated as "fair" for the species group because no species is in immediate danger of losing viability due to this condition, but long-term declines for some species may continue. Recent trends

show very low levels of road construction, which are exceeded by miles of road decommissioning and closure (see "Roads, Trails, and Access Section" of this document). All alternatives include direction to reduce open road densities where compatible with overall multiple-use objectives. As a result, road closures are expected to continue to outpace new construction under all alternatives and time frames, resulting in relatively small overall reductions in open road density forest wide. Given the other multiple-use objectives constraining road closures, ratings are expected to remain at the "fair" level in both the short and long terms, despite improving trends.

Species Group Summary

In general, indicators for most species groups trend toward improving conditions and reach "good" or "very goo"" status over the long term (Tables 3-95 and 3-96). There are exceptions, however. Where indicators remain below these desirable levels, it is generally because of lack of enough ecological disturbance to create desired structural conditions such as open woodlands and forest, regenerating forest patches, canopy gaps, and dense understories. Low disturbance systems are projected to remain abundant or increase under all alternatives.

Table 3-95: Ratings of Current and Expected Habitat Conditions after 10 Years for Species Groups By Alternative-OSFNFs.

Species Group	Alternatives					
	Current	A	B	C	D	E
Glade and Barrens Associates	Poor	Fair	Fair	Fair	Fair	Fair
Cliff and Talus Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Montane Oak Forest Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Canebrake Associates	Poor	Poor	Poor	Poor	Poor	Poor
Seeps and Fens Associates	Fair	Good	Good	Good	Good	Good
Pond and Emergent Wetland Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Cave, Mine, and Karst Associates	Good	Good	Good	Good	Good	Good
Woodland and Grassland Associates	Poor	Poor	Poor	Poor	Poor	Poor
Shortleaf Pine-Bluestem Grass Associates	Poor	Poor	Poor	Poor	Poor	Poor
Open Oak Forest Associates	Poor	Poor	Poor	Poor	Poor	Poor
General Mature Forest Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Mature Mesic Forest Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good

Table 3-95: Ratings of Current and Expected Habitat Conditions after 10 Years for Species Groups By Alternative-OSFNFs. (Continued)

Species Group	Alternatives					
	Current	A	B	C	D	E
Mature Mesic Forest with Canopy Gaps Associates	Poor	Poor	Poor	Poor	Poor	Poor
Mature Mesic Forest with Closed Canopy Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Mature Forest in Riparian Area Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Dense Riparian Understory Associates	Poor	Poor	Poor	Poor	Poor	Fair
Mature Forest Interior Birds	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Regenerating Forest Associates	Fair	Fair	Fair	Fair	Good	Fair
Mixed Successional Forest Associates	Fair	Fair	Fair	Fair	Fair	Fair
Den Tree Associates	Good	Good	Good	Good	Good	Good
Snag Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Species Sensitive to Human Disturbance	Fair	Fair	Fair	Fair	Fair	Fair

Table 3-96: Ratings of Current and Expected Habitat Conditions after 50 Years for Species Groups by Alternative-OSFNFs.

Species Group	Alternatives					
	Current	A	B	C	D	E
Glade and Barrens Associates	Poor	Good	Good	Good	Good	Good
Cliff and Talus Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Montane Oak Forest Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Canebrake Associates	Poor	Poor	Poor	Poor	Poor	Poor
Seeps and Fens Associates	Fair	V. Good	V. Good	V. Good	V. Good	V. Good
Pond and Emergent Wetland Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Cave, Mine, and Karst Associates	Good	Good	Good	Good	Good	Good
Woodland and Grassland Associates	Poor	Poor	Poor	Good	Poor	Good
Shortleaf Pine-Bluestem Grass Associates	Poor	Good	Fair	Good	Poor	V. Good

Table 3-96: Ratings of Current and Expected Habitat Conditions after 50 Years for Species Groups by Alternative-OSFNFs. (Continued)

Species Group	Alternatives					
	Current	A	B	C	D	E
Open Oak Forest Associates	Poor	Poor	Poor	Poor	Poor	Poor
General Mature Forest Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Mature Mesic Forest Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Mature Mesic Forest with Canopy Gaps Associates	Poor	Fair	Fair	Fair	Fair	Fair
Mature Mesic Forest with Closed Canopy Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Mature Forest in Riparian Area Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Dense Riparian Understory Associates	Poor	V. Good	Good	Poor	Fair	V. Good
Mature Forest Interior Birds	V. Good	V. Good	V. Good	Good	V. Good	Good
Regenerating Forest Associates	Fair	Fair	Fair	Fair	Good	Fair
Mixed Successional Forest Associates	Fair	Good	Good	Good	Good	Good
Den Tree Associates	Good	V. Good	V. Good	V. Good	V. Good	V. Good
Snag Associates	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good
Species Sensitive to Human Disturbance	Fair	Fair	Fair	Fair	Fair	Fair

AQUATIC SPECIES

Affected Environment

The OSFNFs fall within four main river drainages: Arkansas, Mississippi, St. Francis, and White. The primary tributaries to these rivers that drain the Forests are Buffalo River, Illinois River, Illinois Bayou, L'Anguille River, Lee Creek, Little Red River, Mulberry River, Petit Jean River, Piney Creek, and St. Francis River. The evaluation areas for aquatic species at the forest plan level are fifth (5^{th}) level hydrologic unit codes (HUCs). These rivers and their tributaries are divided into 51 fifth (5^{th}) level HUCs. HUCs range from 25,079 to 237,071 acres with an average of 98,840 acres per HUC.

The OSFNFs have approximately 1,300 miles of perennial streams that are in the Ozark and Coastal Plain Provinces. The Arkansas River Valley, Boston Mountain, Springfield Plateau, and Salem Plateau sections of the Ozark Province cover the streams on the Ozark NF. The Mississippi Alluvial Plain and Crowley's Ridge sections

cover the St. Francis National Forest. The topography ranges from the Boston Mountains that has relief as much as 1,000 meters to the flat Mississippi Alluvial Plain. Annual precipitation averages 45 to 50 inches in a year on OSFNFs. Flows tend to be more intermittent in the parts of the Arkansas River Valley and Boston Mountains associated with the OSFNFs. The Salem and Springfield Plateaus tend to have a more consistent flow. Average daily air temperatures range from 26 to 50ºF (degrees Fahrenheit) in the winter to 66 to 92ºF in the summer. The overall productivity is relatively low in the Boston Mountains and Arkansas River Valley due to their sandstone and shale geology. The Springfield and Salem Plateau has a significant amount of limestone and tends to have streams that are more productive. For more detailed information, refer to the "Affected Environment" in "Watersheds, Streams, and Water Resources Section." In this section, the Springfield and Salem Plateaus are combined into the Ozark Highlands. In addition, the Mississippi Alluvial Plain is referred to as the Mississippi Bottomlands.

Human population in this area ranges from 0.7 to 435 people per square mile with an average of 46 people per square mile in these HUCs. Primary land uses are forestry, pastures for cattle grazing, poultry farms, and row cropping. Urbanization is primarily occurring in the Arkansas River Valley and Northwest Arkansas in the Springfield Plateau.

Habitat alteration is 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).

Activities within the watershed determine habitat quality within a freshwater ecosystem (Abell et al. 2000; Scott and Helfman 2002). Therefore, the influence of these activities upon habitats, or water bodies, can be described to determine the condition of the habitat.

To determine if there is adequate habitat for these species, the condition of each individual watershed 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 reasonable or 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.

Species of Viability Concern

A comprehensive list of aquatic species with potential viability concern was compiled for the OSFNFs (Table 3-97). The list includes those species found both on and downstream (within 5th level HUC) from the OSFNFs in 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, and
- Species identified as locally rare and of special concern by species experts.

The condition of each watershed was assessed using the following criteria:

- **Sedimentation** was assessed separately by determining the percent increase above the baseline sediment levels by watershed as assessed with the Watershed Condition Ranking (WCR). This process is described in detail in the Appendix B, Sediment Yield section. Watershed ranks derived from the WCR model for each alternative over the five decades are given in Table 3-13.
- **Point Source Pollutants** (density of point sources).
- **Riparian Habitat** (road density in the riparian area and percent forest in the riparian area).
- **Altered stream flow** (density of dams, road density in the riparian, and average density of strip-mines).

For each watershed and species, sensitivity to condition categories was assigned based on the species viability evaluation database, published literature, and personal communications (AGFC Ozark NF SVE 2004). Species sensitivity to the four condition categories was compared with the condition of their respective watersheds to assess the threats to their persistence in the planning area. Threats to aquatic species viability are not limited to these four variables; however, GIS coverage is not available for channelization, introduced species, and over-harvest. For forest-level planning, it is assumed that these four condition categories are adequate when identified by watershed land disturbance activities in the planning area.

Specific information is not available to determine the relationship between individual species and point source, riparian habitat, or altered flows; however, the establishment of groups identified by Jenk's optimization process illustrates the relative magnitude of each stressor within the range of current conditions. The relationship between fish community structure and sediment increase is definable and is discussed further in the Appendix B, Sediment Profile Section. As a result, sediment increase is the primary metric used for assessing the risk of maintaining viable populations of aquatic species. It is important to keep in mind, however, that the effect of any of the remaining stressors may increase the risk to aquatic fauna in a watershed.

Viability for each species of concern was determined for each watershed where a species occurs, because in many cases watersheds support separate populations, and factors affecting viability can vary considerably from watershed to watershed. Viability determinations incorporate 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. Viability determinations are:

- **Outcome 1.** Species occur within the watershed with no impairment. Likelihood of maintaining viability is high.
- **Outcome 2.** Species viability is potentially at risk in the watershed and the extent and location of national forest (NF) lands with respect to the species is conducive to positively influencing the viability of the species within this watershed. Therefore, likelihood of maintaining viability is moderate.
- **Outcome 3.** Species viability is potentially at risk within the watershed; however, the extent and location of NF lands with respect to the species is NOT conducive to positively influencing the viability of the species within this watershed. Therefore, likelihood of maintaining viability is low.
- **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 random events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. The extent and location of NF lands with respect to the species is conducive to positively influencing the viability of the species within this watershed. 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 random events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. The extent and location of NF lands with respect to the species is NOT conducive to positively influencing the viability of the species within this watershed. Therefore, likelihood of maintaining viability is low.

Of the 51 HUCs, 14 were considered to be at high risk for maintaining species viability under current conditions. These watersheds tend to be in areas that have a higher percentage of agriculture and urban land uses such as the Arkansas River Valley and Northwest Arkansas. Forest Service ownership of lands within these HUCs ranges from less than 1 to 32 percent with an average of 3 percent. In general, the likelihood of maintaining aquatic species viability in these watersheds is low.

The likelihood of maintaining viable populations of aquatic species was classified as moderate for 10 of the HUCs. Six of these HUCs also show moderately high-to-high scores with respect to the relative state of at least one of the remaining perturbations (point source, riparian habitat or altered flows) Table 3-119.

Twenty-seven HUCs show little impairment related to sediment and, therefore, they are considered capable of maintaining viable population of aquatic species. Nine of these HUCs, however, show moderately high-to-high scores with respect to the relative state of at least one of the remaining perturbations Table 3-119.

At least 150 species of fish and 52 mussels are found in the 51 HUCs identified in this analysis area. Twenty-two species were identified as having viability concerns. For each of these 22 species, the likelihood of maintaining viability was determined by the WCR.

HUC importance was determined by interviewing species experts. These experts used the following factors to assist with determining the HUC importance: the range of the species, the number of elements of occurrence, the percentage of the populations

believed to be associated with each watershed, distribution of the species within the watershed, and habitat suitability and natural limiting factors.

Table 3-97: Lists All Federally Threatened and Endangered Species, Regional Forester's Sensitive, and Species of Viability Concern Used in the Aquatic Viability Assessment for OSFNFs.

Common Name	Scientific Name	Classification	S-Rank	G-Rank
Crayfish				
A crayfish	*Cambarus causeyi*	Viability Concern	S1	G1
Fish				
Arkansas Darter	*Etheostoma cragini*	Viability Concern	S1	G3
Least Darter	*Etheostoma microperca*	Viability Concern	S1	G5
Longnose Darter	*Percina nasuta*	Regional Forester's Sensitive	S2	G3
Ozark Cavefish	*Amblyopsis rosae*	Federally Endangered	S1	G2/G3
Ozark Shiner	*Notropis ozarcanus*	Regional Forester's Sensitive	S3	G3
Pallid Sturgeon	*Scaphirhynchus albus*	Federally Endangered	S1	G1
Southern Cavefish	*Typhlichthys subterraneus*	Regional Forester's Sensitive	S1	G4
Mussel				
Black Sandshell	*Ligumia recta*	Viability Concern	S2	G5
Ebonyshell	*Fusconaia ebena*	Viability Concern	S3/S4	G4/G5
Elktoe	*Alasmidonta marginata*	Viability Concern	S3	G4
Fat Pocketbook	*Potamilus capax*	Federally Endangered	S1	G1
Fatmucket	*Lampsilis siliquoidea*	Viability Concern	S3	G5
Flat Floater	*Anodonta suborbiculata*	Viability Concern	S1	G5
Flutedshell	*Lasmigona costata*	Viability Concern	S3	G5
Neosho mucket	*Lampsilis rafinesqueana*	Federal Candidate Species	S1	G2
Ouachita Kidneyshell	*Ptychobranchus occidentalis*	Viability Concern	S3	G3/G4
Pink Mucket	*Lampsilis abrupta*	Federally Endangered	S2	G2
Purple Lilliput	*Toxolasma lividus*	Viability Concern	S2	G2
Rabbitsfoot	*Quadrula cylindrical cylindrica*	Viability Concern	S2	G3
Scaleshell	*Leptodea leptodon*	Federally Endangered	S1	G1
Speckled pocketbook	*Lampsilis streckeri*	Federally Endangered	S1	G1Q

CRAYFISH

Crayfish (*Cambarus causeyi*)

Cambarus causeyi (Viability Concern) is endemic to Arkansas and is found only in Johnson, Madison, Newton, Pope, Searcy, and Stone Counties. There is limited information on the life history of this species. Researchers believe that this species is restricted to seeps, springs, and habitats immediately adjacent to these areas. Since it is a burrowing crayfish, this species is probably not sensitive to increases in sedimentation, but maintaining the appropriate hydrology is important to the viability of the species. This species has been identified in 8 watersheds and it is speculated that the species is present in 10 more watersheds on the Ozark NF (Table 3-98). These 18 watersheds encompass most of the main unit of the Ozark NF. There have been two watersheds identified as critical to the viability of the species: Upper Mulberry River and Little Piney. The FS primarily owns the Upper Mulberry, but the Little Piney has most of the watershed in private ownership. Of the eight watersheds in which the species has been identified, Upper White River (Outcome 2) and Little Piney (Outcome 3) watersheds have a moderately high-risk ranking for riparian health. This higher risk ranking for riparian health is primarily due to the amount of pastures in the riparian zones on private lands. The rest of the perturbations were ranked as low to moderate risk. Spadra Creek is ranked in the higher risk categories for all perturbation categories. Spadra Creek is in the Arkansas River Valley, which has been highly developed (Outcome 3). The remaining five watersheds are considered to be at lower risk for viability issues. Populations have been found in these watersheds on National Forest Lands (Outcome 2).

Table 3-98: Watersheds on the OSFNFs Inhabited by Crayfish.

Watershed	5th Level HUC Identifier	Outcome
Big Piney Creek	1111020211	2
Buffalo River	1101000501	2
Little Piney Creek	1111020208	3
Middle Fork Illinois Bayou	1111020213	2
Mulberry River	1111020107	2
Spadra Creek	1111020205	3
Upper Mulberry River	1111020106	2
Upper White River	1101000101	2

FISH

Arkansas Darter (*Etheostoma cragini*)

Arkansas darter (Viability Concern) habitat is characterized as small permanent-flow springs and spring run creeks with aquatic vegetation such as watercress. This species is in the Osage Creek HUC (Table 3-99). There is a significant concern about the viability of this species in the state, and experts believe that it will be exterminated from Arkansas if current trends in development of Northwest Arkansas continue. The Arkansas darter has not been documented in springs on or adjacent to Forest Service lands. In addition, the

Forest Service owns approximately one percent of the Osage Creek HUC. For these reasons, management activities on Ozark NF are not likely to influence the viability of this species (Outcome 3).

Table 3-99: Watershed on OSFNFs Inhabited by Arkansas Darter.

Watershed	5th Level HUC Identifier	Outcome
Osage Creek	1111010303	3

Least darter (*Etheostoma microperca*)

Least darter (Viability Concern) inhabits small clear springs and quiet pools of spring creeks having permanent flow. Typically, the substrate is graveled with accumulations of detritus (fragments of rock), thick growth of watercress, and filamentous algae. In the analysis area, the species is found in the Illinois River and Osage Creek HUCs (Table 3-100). The species is known from three localities and currently believed to be exterminated from the site in the Illinois River HUC. The species' strongest population is in Healing Springs, which is heavily impacted by local farming practices surrounding the spring. The impact of urbanization on ground water quality is another concern. The least darter like the Arkansas darter has viability concerns and it is expected to be extirpated from the state based upon recent land development trends of Northwest Arkansas. Least darter has not been documented in springs and/or adjacent stream sections on the OSFNFs. In addition, the Forest Service owns approximately one percent of the Osage Creek HUC. For these reasons, management activities on OSFNFs are not likely to impact the viability of this species (Outcome 3).

Table 3-100: Watershed on OSFNFs Inhabited by Least Darter.

Watershed	5th Level HUC Identifier	Outcome
Illinois River	1111010301	3
Osage Creek	1111010303	3

Longnose darter (*Percina nasuta*)

Longnose darter (Regional Forester's Sensitive Species) utilizes small to medium rivers. It is believed that this species is highly sensitive to alterations in flow regimes. Activities such as dam construction have significantly decreased this species habitat. Unlike several of the other darter species, the longnose darter is believed to be moderately sensitive to changes in sedimentation rates. The longnose darter occurs in nine watersheds in the analysis area and six watersheds have at least one of the four perturbations ranked as moderately high-to-high risk (Table 3-101). Each of these six watersheds has less than 14 percent of the land base in Forest Service ownership. Factors outside Forest Service control (Outcome 3) will greatly influence the viability of this species. The Forest Service owns a majority of three of the five watersheds that were determined to be critical or important to the viability of the longnose darter. These watersheds are considered low to moderate risk for viability issues (Outcome 2).

Table 3-101: Watersheds on OSFNFs Inhabited by Longnose Darter.

Watershed	5th Level HUC Identifier	Outcome
Big Piney Creek	1111020211	2
Cove Creek/Lee Creek	1111010404	3
Frog Bayou	1111020105	3
Illinois Bayou	1111020214	3
Little Mulberry Creek	1111020108	3
Mulberry River	1111020107	2
North Fork Illinois Bayou	1111020212	2
Webber Creek	1111010405	3
White River	1101000102	3

Ozark Cavefish (*Amblyopsis rosae*)

Ozark cavefish (Federally Threatened) is a small, colorless, and blind fish that lives its entire life in springs, cave streams, and underground waters. It is morphologically adapted to living in cave environments. The largest threats to this species are water pollution, habitat destruction, human disturbance, and collection. This species is found in only one watershed (Osage Creek) within the analysis area (Table 3-102). This watershed shows a medium risk from sedimentation and is in Northwest Arkansas where development and human populations are expanding at an alarming rate. Within this watershed, the Ozark cavefish has been found in only one location, Logan Cave. This cave is protected as a National Wildlife Refuge by the USFWS. The species has not been found in any water sources on or adjacent to the Ozark NF. The recharge area for Logan Cave is outside the OSFNFs' boundary. The Ozark NF owns less than one percent of the Osage Creek watershed. For these reasons, future management activities on the Ozark NF will have no effect on the viability of this species (Outcome 3).

Table 3-102: Watershed on OSFNFs Inhabited by Ozark Cavefish.

Watershed	5th Level HUC Identifier	Outcome
Osage Creek	1111010303	3

Ozark Shiner (*Notropis ozarcanus*)

Ozark shiner (Regional Forester's Sensitive Species) is a high gradient fish species that prefers large streams and rivers. It is endemic to the Ozark Uplands of northern Arkansas and southern Missouri. The Ozark shiner occurs in the White and Black River systems (Table 3-103). A disjunct population has been found in the Illinois River system. The largest threats to this species seem to be from reservoir construction that causes habitat loss and fragmentation of populations. In addition, impacts from overall habitat loss caused by altered stream channels, altered riparian areas (loss of trees causing changes like increases in temperature), and sedimentation.

Ozark shiner experts consider the Barren Creek watershed very important to the overall viability of this species. They currently categorize the population of Ozark shiner in this watershed as probably not being viable. This watershed seemed least influenced by the

overall current impacts (sediment, water quality, temperature, and altered flow regimes). The OSFNFs currently own 21.6 percent of the watershed. Although this species has not been found on national forest land, the OSFNFs own land in the watershed directly above the locations where it has been found. The WCR model predicted low increases in sediment for all five alternatives for the next five decades. Given forest-wide standards, future forest management activities may impact individuals but is not likely to cause a trend to federal listing or a loss of viability of Ozark shiner in the Barren Creek watershed (Outcome 2).

Three other watersheds were considered by the experts to currently have populations that were probably not viable (War Eagle Creek, King's River, and Rocky Bayou). These watersheds also had low amounts of Forest Service ownership (War Eagle Creek-<1 percent; King's River–5.2 percent; and Rocky Bayou–19.5 percent). Populations of Ozark shiner have not been found on NF lands in any of these watersheds. For these reasons, future management activities on the OSFNFs will have no impact on the viability of this species in these watersheds (Outcome 3). In the remaining four watersheds in which this species is found, the experts believe that fairly viable populations of Ozark shiner exist. These watersheds do not show to be heavily impacted in relations to the other 5th level watersheds on the OSFNFs. For these reasons, future management activities on the OSFNFs will have no impact on the viability of this species in these watersheds (Outcome 1).

Table 3-103: Watersheds on OSFNFs Inhabited by Ozark Shiner.

Watershed	5th Level HUC Identifier	Outcome
Barren Creek	1101000401	1
Big Creek	1101000505	2
Buffalo River	1101000501	1
Kings River	1101000109	3
Little Buffalo River	1101000502	1
Richland Creek/Cave Creek	1101000503	1
Rocky Bayou	1101000403	3
War Eagle Creek	1101000106	3

Pallid Sturgeon (*Scaphirhynchus albus*)

Pallid sturgeon (Federally Endangered) is a big river species and currently believed to be restricted to the Mississippi River. Lindsey Lewis, the lead USFWS biologist for this species, indicated that the species could be in the St. Francis River, but it would probably be restricted to the area just upstream of the confluence with the Mississippi River (Table 3-104). The limiting factors and potential threats are not fully understood, but are believed to be caused by navigation and flood control activities that alter flow regimes and the morphology of the river. Some examples are impoundments and dredging.

Large river systems that the pallid sturgeon inhabits are stable and are very resilient to potential effects caused by changes in land use or management activities on a smaller scale. Lewis also stated that he did not believe any Forest Service

management activities would affect the species habitat or the viability of the species because:

- Activities to be implemented by the Forest Service would not directly alter the river characteristics (channels and shoals), and
- The St. Francis NF is too small to significantly impact the river system and pallid sturgeon habitat (Outcome 3).

Table 3-104: Watershed on OSFNFs Inhabited by Pallid Sturgeon.

Watershed	5th Level HUC Identifier	Outcome
Phillips Bayou	0802020334	3
Mississippi River	0802010002	3

Southern cavefish (*Typhlichthys subterraneus*)

Southern cavefish (Regional Forester's Sensitive Species) is known from a cave in the South Sylamore Creek Watershed (Table 3-105). This cave is not found on FS lands, but part of the recharge area is in FS ownership. The exact recharge area is not known for this cave. Primary threats are land uses that alter flow regimes and decrease water quality in the cave recharge area such as urbanization and suburban housing, municipal sewage treatment plants, confined animal operations, and roads. Conditions in this HUC amenable to maintaining the species viability are good, but the true status of this species is unknown due to the difficulties of collecting population data. This species inhabits the aquifer as well as the streams in the cave. Population information such as abundance and recruitment is limited to certain sections of the cave, and does not give an accurate representation of the true status of the species. FS owns 45 percent of this HUC (Outcome 4).

Table 3-105: Watershed on OSFNFs Inhabited by Southern Cavefish.

Watershed	5th Level HUC Identifier	Outcome
South Sylamore Creek	1101000404	4

MUSSELS

Black Sandshell (*Ligumia recta*)

Black sandshell (Viability Concern) inhabits big streams to medium large rivers. The species is found only in the Big Piney Creek within the analysis area and suitable habitats in this HUC are considered limited (Table 3-106). The species status is currently unknown in the watershed. Forest Service controls management activities on 70 percent of the HUC, but may not be able to maintain a viable population of this species in the HUC due to natural limiting factors (Outcome 4).

Table 3-106: Watershed on OSFNFs Inhabited by Black Sandshell.

Watershed	5th Level HUC Identifier	Outcome
Big Piney Creek	1111020211	4

Ebonyshell (*Fusconaia ebena*)

Ebonyshell (Viability Concern) is a big river species but has been found in four watersheds (Table 3-107). Three of the watersheds are on the Ozark NF: Big Piney Creek, Cedar Creek, and War Eagle Creek. The species is rare to uncommon in these watersheds, and natural habitat limitations are significant. In fact, these watersheds may not be able to support viable populations and the status of the species is unknown. The St Francis NF has one watershed (Phillips Bayou) that supports a viable population, but is being significantly limited by stream alterations such as irrigation ditches and channelization. In addition, commercial harvest is a significant threat to this species. Factors outside Forest Service control will have a significant influence on the long-term viability of the species (Outcome 3).

Table 3-107: Watersheds on OSFNFs Inhabited by Ebonyshell.

Watershed	5th Level HUC Identifier	Outcome
Big Piney Creek	1111020211	3
Cedar Creek	1111020403	3
Phillips Bayou	0802020334	3
War Eagle Creek	1101000106	3

Elktoe (*Alasmidonta marginata*)

Elktoe (Viability Concern) is considered a riffle species that typically inhabits smaller streams. This species has been identified in 10 watersheds, of which only the Illinois River and Frog Bayou watersheds are considered to be moderately high to high risk watersheds (Table 3-108). Streams in both of these watersheds have been altered by land uses such as urbanization and agriculture. FS owns less than 10 percent of these watersheds. As a result, FS does not control management activities on the majority of the land within these watersheds. Ultimately, the future viability of this species in these watersheds will be determined by factors outside FS control (Outcome 3). The FS does own the majority of the five watersheds that were determined to be most important to the viability of the species. Currently, these watersheds are considered low risk for viability issues (Outcome 1).

Table 3-108: Watersheds on OSFNFs Inhabited by Elktoe.

Watershed	5th Level HUC Identifier	Outcome
Big Creek	1101000505	1
Big Piney Creek	1111020211	3
Cove Creek/Lee Creek	1111010404	1
Frog Bayou	1111020105	3
Illinois River	1111010301	3
Middle Fork Illinois Bayou	1111020213	1
Mulberry River	1111020107	3
North Fork Illinois Bayou	1111020212	1
Upper Big Piney Creek	1111020209	3
Upper Frog Bayou	1111020104	3

Fat Pocketbook (*Potamilus capax*)

Fat pocketbook (Federally Endangered Species) is found in L'Anguille River and Phillips Bayou Watersheds on the St. Francis NF (Table 3-109). This species is typically found in large rivers in slow-flowing water (often near the bank) in mud or sand. Based on conversations with John Harris (state mussel expert), the better habitats are upstream from the St. Francis NF. The major threats to the species are dredging and impoundments. The largest population of fat pocketbook occurs in the St. Francis Floodway. Local interests and the U.S. Army Corp (to subsidize agricultural interests) have substantially altered this watershed. Most of the stream channels have been dredged or straightened for flood control. FS does not own the area surrounding the better habitats and has no control of activities that occur in these areas. In HUCs that contain FS land, the Phillips Bayou Watershed contains 46 percent forest ownership and L'Anguille River Watershed contains less than one percent forest ownership. FS activities could influence the viability in the Phillips Bayou HUC (Outcome 4), but would not affect viability in L'Anguille River (Outcome 5). These two HUCs, however, are not considered to be important to the overall viability of the species.

Table 3-109: Watershed on OSFNFs Inhabited by Fat Pocketbook.

Watershed	5th Level HUC Identifier	Outcome
L'Anguille River	0802020513	5
Phillips Bayou	0802020334	4

Fat Mucket (*Lampsilis siliquoidea*)

Fat mucket (Viability Concern) is found in the Illinois River and Wedington Creek HUCs (Table 3-110). The species is found in small to medium-sized streams in mud, sand, or gravel substrates. The primary threat is alteration of flow regimes. The Illinois River and Wedington Creek HUCs are found in a part of Arkansas that is rapidly being developed, and the FS owns less than 15 percent of the total land base encompassed by these HUCs. For these reason, Forest Service management activities or administrative decisions will have little impact on the long-term viability

of this species within the analysis area (Outcome 5). The Illinois River and Wedington Creek HUCs are not considered important to the long-term viability of the species.

Table 3-110: Watershed on OSFNFs Inhabited by Fat Mucket.

Watershed	5th Level HUC Identifier	Outcome
Illinois River	1111010301	5
Wedington Creek	1111010306	5

Flat Floater (*Anodonta suborbiculata*)

Flat floater (Viability Concern) is found in the backwater areas such as sloughs and is a wide-ranging species. Within the analysis area, the species has been documented in two HUCs on the OSFNFs and is considered uncommon (Table 3-111). Habitat limitations are believed to be minimal, but activities that reduce the backwaters such as channelization are the primary threat to the species. Currently, this species is probably viable in these HUCs but is found in HUCs that have a lot of urban and/or agricultural land use. FS owns less than 7 percent of these watersheds. As a result, management activities on FS lands have a limited influence on the species future viability in these HUCs and will be determined by factors outside Forest Service control (Outcome 3). In addition, the importance of these HUCs to the global species viability is relatively low, considering its range extends well beyond the analysis area.

Table 3-111: Watershed on OSFNFs Inhabited by Fat Floater.

Watershed	5th Level HUC Identifier	Outcome
L'Anguille River	0802020513	3
Arkansas River	1111020215	3

Flutedshell (*Lasmigona costata*)

Flutedshell (Viability Concern) is a mussel species that prefers to live in sand, mud, and/or small gravel areas of medium to large rivers. Impacts to this species are loss of habitat, alterations in flow regimes, and changes in sedimentation. This species is known from 12 of the 5th level watersheds on the Ozark NF (Table 3-112). Two of the watersheds currently have populations for which little is known (Frog Bayou and Mulberry River). Frog Bayou has only 6.2 percent Forest Service ownership and Mulberry River has 82.3 percent. Frog Bayou Watershed has characteristics that point to it being currently heavily impacted by sediment. The WCR model also predicts that there will be a high increase in sediment for all the alternatives over the next five decades caused by activities on private lands in this watershed.

The Mulberry River Watershed shows to be currently in good condition, and the WCR model predicts low increases in sediment in these watersheds for the next five decades for all the alternatives. Flutedshell has yet to be found on National Forest lands. Given these factors, Ozark NF management activities may impact individuals but are not likely to cause a trend to federal listing or a loss of viability in these watersheds (Outcome 2).

In War Eagle Creek Watershed, the Forest Service owns < 1 percent of the watershed and populations of flutedshell have not been found on the Ozark NF so the Forest will have no impact to viability of this species in this watershed. In the remaining watersheds, the ownership ranges from 5.3 to 82.1 percent and populations have been found on the Ozark NF in some of the watersheds. Given these factors, Ozark NF management activities may impact individuals but is not likely to cause a trend to federal listing or a loss of viability in these watersheds (Outcome 2).

Table 3-112: Watersheds on OSFNFs Inhabited by Flutedshell.

Watershed	5th Level HUC Identifier	Outcome
Big Creek	1101000505	2
Big Piney Creek	1111020211	2
Cove Creek/Lee Creek	1111010404	2
Frog Bayou	1111020105	2
Illinois River	1111010301	2
Little Buffalo River	1101000502	2
Middle Fork Illinois Bayou	1111020213	2
Mulberry River	1111020107	2
Richland Creek/Cave Creek	1101000503	2
Upper Big Piney Creek	1111020209	2
War Eagle Creek	1101000106	3
Wedington Creek	1111010306	2

Neosho Mucket (*Lampsilis rafinesqueana*)

Neosho mucket (Regional Forester's Sensitive Species) is endemic to Arkansas, Kansas, Missouri, and Oklahoma. It is found in the Illinois River and Wedington Creek HUCs (Table 3-113). The species is showing decline across its range. The primary threats are impoundments and land development for urban and agricultural land uses. The Illinois River and Wedington Creek HUCs are found in a part of Arkansas that is rapidly being developed, which increases the probability that this species will have viability issues in Arkansas in the future. The FS does not own the land where this species has been currently found and owns less than 15 percent of the total land base encompassed by these HUCs; therefore, FS management activities will have little impact on the long-term viability of this species within the analysis area (Outcome 3).

Table 3-113: Watershed on OSFNFs Inhabited by Neosho Mucket.

Watershed	5th Level HUC Identifier	Outcome
Illinois River	1111010301	3
Wedington Creek	1111010306	3

Ouachita Kidneyshell (*Ptychobranchus occidentalis*)

Ouachita kidneyshell (Viability Concern) is endemic to Arkansas, Kansas, Louisiana Missouri, and Oklahoma. Impacts to this species are loss of habitat, alterations in flow regimes, and changes in sedimentation. Ouachita kidneyshell has been identified in seven watersheds in the analysis area (Table 3-114). Experts have identified two of these watersheds (War Eagle Creek and King's River) as being important to the Forests' level of viability for this species. Both of these watersheds have a low percentage of FS ownership, < 1 percent and 5.2 percent respectively. Currently, no known populations have been found on FS lands in these two watersheds and the populations that have been found are at the most downstream point in these watersheds (Ozark NF lands are in the headwaters of these watersheds). Given these reasons, forest management activities will have no impact on the viability of Ouachita kidneyshell in these watersheds (Outcome 3). Wedington Creek and Illinois River are in areas were the human population growth is high. The experts feel that populations of Ouachita kidneyshell in these two watersheds are currently viable and stable. These watersheds show moderate impacts from hydrologic modifications, riparian health, pollution sources, and sedimentation at the present when compared to the other watersheds in the analysis area. Currently, no populations of Ouachita kidneyshell have been found on Ozark NF lands. Given these reasons, FS management activities will have no impact on the viability of Ouachita kidneyshell in these watersheds (Outcome 3). The remaining three watersheds contain fairly large percentages of FS ownership (14.7 to 19.4%), contain populations of Ouachita kidneyshell on the Forests or close to the boundary, and are in fairly good current condition when compared to the other watersheds in the analysis area. With forest-wide standards, forest management activities may impact individuals but are not likely to cause a trend to federal listing or a loss of viability for the Ouachita kidneyshell in these watersheds (Outcome 2).

Table 3-114: Watersheds on OSFNFs Inhabited by Ouachita Kidneyshell.

Watershed	5th Level HUC Identifier	Outcome
Big Creek	1101000505	2
Illinois River	1111010301	2
Kings River	1101000109	3
Little Buffalo River	1101000502	2
Richland Creek/Cave Creek	1101000503	2
War Eagle Creek	1101000106	3
Wedington Creek	1111010306	2

Pink Mucket (*Lampsilis abrupta*)

Pink mucket (Federally Endangered Species) has not been recorded in any of the HUCs in the analysis area. The species had been included on past Threatened and Endangered Species List for the OSFNFs. John Harris, a state mussel expert, and Chris Davidson, the state lead USFWS biologist for the species, stated that management activities on the OSFNFs should not affect this species.

Purple Lilliput (*Toxolasma lividus*)

Purple lilliput (Viability Concern) has a preferred habitat of small to medium rivers. It is usually found in gravel substrate. The major impacts to this species are sedimentation, loss of stream flow, and anything that changes riffle sequences in the upper watershed. Purple lilliput has been found in eight of the watersheds in the analysis area (Table 3-115). All the watersheds have populations of this species that are considered stable by the experts, but that are also considered to be restricted and spotty within the watersheds. Illinois River and Illinois Bayou have small amounts of FS ownership (9.2% and 7.2%, respectively), but populations of purple lilliput have been found on the Ozark NF in both watersheds. They both show current condition in the medium range when analyzed for hydrologic modification, riparian health, pollution sources, and sedimentation when compared to the other watersheds in the analysis area. The WCR model predicts medium increased risk to species in the Illinois River Watershed and high increased risk to species in the Illinois Bayou Watershed from sediment for all the alternatives. Given these factors, forest management activities may impact individuals but is not likely to cause a trend to federal listing or a loss of viability for purple lilliput in these watersheds. Most of the influence on populations of this species will come from lands in private ownership (Outcome 2). In the other six watersheds, ownership ranges from 40.3 to 85.9 percent. These watersheds are currently in good condition and the WCR model predicts low impacts from sediment increases. Some populations of purple lilliput in these watersheds are found on FS lands and others are found on other lands just downstream of the Ozark NF boundary. Given these factors, forest management activities may impact individuals but are not likely to cause a trend to federal listing or a loss of viability for purple lilliput in these watersheds. Most of the influence on populations of this species will come from lands in private ownership (Outcome 2).

Table 3-115: Watersheds on OSFNFs Inhabited by Purple Lilliput.

Watershed	5th Level HUC Identifier	Outcome
Big Piney Creek	1111020211	2
Illinois Bayou	1111020214	2
Illinois River	1111010301	2
Middle Fork Illinois Bayou	1111020213	2
Mulberry River	1111020107	2
North Fork Illinois Bayou	1111020212	2
Richland Creek/Cave Creek	1101000503	2
Upper Big Piney Creek	1111020209	2

Rabbitsfoot (*Quadrula cylindrical cylindrical*)

Rabbitsfoot (Viability Concern) has a typical habitat that is small to medium rivers with moderate to swift currents. In smaller streams, it inhabits areas with substrates of gravel and cobble close to the fast current. This species is found in four watersheds in the analysis area (Table 3-116). The Wedington Creek Watershed has been identified as a critical watershed for maintaining the viability of the species. This watershed ranked as moderately high risk for hydrologic modification and

riparian health. In fact, three of the four watersheds have at least one perturbation in the higher risk categories. These watersheds are located in Northwest Arkansas where local streams have been significantly altered by development. FS owns less than 6 percent of the Wedington Creek Watershed and less than 20 percent of the other three watersheds. Management activities outside of FS control will have a significant affect on the long-term viability of this species (Outcome 3).

Table 3-116: Watersheds on OSFNFs Inhabited by Rabbitsfoot.

Watershed	5th Level HUC Identifier	Outcome
Illinois River	1111010301	3
Little Buffalo River	1101000502	3
War Eagle Creek	1101000106	3
Wedington Creek	1111010306	3

Scaleshell (*Leptodea leptodon*)

Scaleshell (Federally Endangered Species) is found only in the Frog Bayou (Table 3-117). This species typically occurs in riffles with moderate-to-high gradients in creeks to large rivers with relatively strong currents. This species is highly sensitive to alterations in flow and temperature regimes, decreases in water quality, and increases in sedimentation. Frog Bayou has a high percentage of land in agriculture and urban use. As a result, the streams in this HUC have been altered. There is little known about the status of the species in this HUC, but it is believed that the species does not have a viable population in this HUC because of the stream alterations that have occurred. Forest Service owns less than seven percent of this HUC. Management activities on Forest Service land have a limited influence on the species future viability in Frog Bayou. Future viability will be determined by factors outside of Forest Service control (Outcome 3).

Table 3-117: Watershed on OSFNFs Inhabited by Scaleshell.

Watershed	5th Level HUC Identifier	Outcome
Frog Bayou	1111020105	3

Speckled Pocketbook (*Lampsilis streckeri*)

Speckled pocketbook (Federally Endangered Species) is found in the South Fork of the Little Red River and is endemic to the Little Red River drainage in Arkansas. This species is typically found in the areas immediately above and below riffles with sand and/or gravel substrates. The species probably can survive short-term stream drying (less than two weeks), but long-term stream drying that would occur in the upper part of this HUC may limit the distribution of the species. This species is believed to be restricted to the main stem of the Little Red River and approximately the eastern half of the HUC (Table 3-118). The primary threats to the species are decrease in water quality and alteration in temperature and flow regimes. Presently, the HUC is in overall good conditions. The FS owns approximately 19 percent of the HUC, which is primarily in the western half of the HUC. The Gulf Mountain Management Area owned

by the Arkansas Game and Fish Commission is a significant portion of this HUC. The strongest populations are found on the Middle Fork of the Little Red River. As a result, the continued viability of the species will depend on conservation actions outside of the areas controlled by the Forest Service (Outcome 1).

Table 3-118: Watershed on OSFNFs Inhabited by Speckled Pocketbook.

Watershed	5th Level HUC Identifier	Outcome
Little Red River	110100403	1

Table 3-119 shows the risk assigned to each 5th level watershed on the OSFNFs for the four potential aquatic risk categories and an overall rating for current conditions. Sediment scores were based on WCR model. The three other factors and the overall score were based on comparing watersheds to each other using Jenk's natural breaks for three categories.

Table 3-119: Risk Assigned to Each 5th Level Watershed on the OSFNFs.

HUC Number	HUC Name	Current Condition Risk - Rating				
		Stream Channel Modification	Impacted Riparian Health	Point Source Pollution	Sediment WCR Model	Overall
802010002	Mississippi River	[1]L	[2]M	L	L	L
802020334	Phillips Bayou	M	L	M	L	L
802020513	L'Anguille River	L	M	[3]H	H	H
802030404	Lick Creek	H	H	H	H	H
802030405	Beaver Bayou Ditch	M	H	M	H	H
1101000101	Upper White River	M	M	L	L	L
1101000102	White River	M	M	L	L	M
1101000103	Middle Fork of White River	M	H	M	L	M
1101000104	West Fork White River	H	H	H	H	H
1101000106	War Eagle Creek	M	H	L	L	M
1101000109	Kings River	M	M	L	L	L
1101000401	Barren Creek	M	M	H	L	M
1101000403	Rocky Bayou	L	M	L	L	L
1101000404	North Sylamore Creek	M	L	M	L	L
1101000501	Buffalo River	L	L	L	L	L
1101000502	Little Buffalo River	M	L	M	L	L
1101000503	Richland Creek/Cave Creek	L	L	L	L	L

[1]L – Low; [2]M - Moderate; [3]H - High

Table 3-119: Risk Assigned to Each 5th Level Watershed on the OSFNFs. (Continued)

HUC Number	HUC Name	Current Condition Risk Rating				
		Stream Channel Modification	Impacted Riparian Health	Point Source Pollution	Sediment WCR Model	Overall
1101000505	Big Creek	[1]L	[2]M	M	L	L
1101001403	South Fork of Little Red River	L	L	L	L	L
1101001404	Archey Creek	L	L	L	L	L
1111010301	Illinois River	[3]H	M	M	M	M
1111010303	Osage Creek	H	H	H	M	H
1111010304	Muddy Fork	H	H	M	M	H
1111010306	Wedington Creek	H	M	L	L	M
1111010307	Baron Fork	M	H	L	L	M
1111010404	Cove Creek/ Lee Creek	L	L	L	L	L
1111010405	Webber Creek	M	M	L	M	M
1111020104	Upper Frog Bayou	M	L	L	L	L
1111020105	Frog Bayou	H	M	M	H	H
1111020106	Upper Mulberry River	L	L	L	L	L
1111020107	Mulberry River	M	L	M	L	L
1111020108	Little Mulberry River	H	H	M	H	H
1111020109	White Oak Creek	M	H	H	H	H
1111020204	Short Mountain Creek	H	M	H	H	M
1111020205	Spadra Creek	[3]H	H	H	H	H
1111020206	Horsehead Creek	H	H	[2]M	M	H
1111020207	Cane Creek	H	H	H	H	H
1111020208	Little Piney Creek	M	M	M	[1]L	M
1111020209	Upper Big Piney Creek	L	L	L	L	L
1111020210	Big Shoal Creek	M	M	M	M	M
1111020211	Big Piney Creek	L	L	L	L	L
1111020212	North Fork Illinois Bayou	L	L	L	L	L
1111020213	Middle Fork Illinois Bayou	L	L	L	L	L
1111020214	Illinois Bayou	H	M	M	H	M
1111020215	Arkansas River	H	H	H	H	H
1111020305	Hackers Creek	H	M	L	M	M

[1]L – Low; [2]M - Moderate; [3]H - High

Table 3-119: Risk Assigned to Each 5th Level Watershed on the OSFNFs. (Continued)

HUC Number	HUC Name	Current Condition Risk Rating				
		Stream Channel Modification	Impacted Riparian Health	Point Source Pollution	Sediment WCR Model	Overall
1111020306	Brock Creek/ West Fork Point Remove	M	L	L	M	L
1111020402	Revilee Creek	L	M	L	M	L
1111020403	Cedar Creek	H	M	L	H	M
1111020404	Chickalah Creek	M	M	M	M	M

[1]L – Low; [2]M - Moderate; [3]H - High

Direct and Indirect Effects

The risk ranking for sedimentation did not vary from the current rank among alternatives.

As far as the three other perturbations, most of the factors used in this analysis will not be affected by the management activities that are proposed in these alternatives, but road density, road crossings, and road density in the riparian areas can be affected by management activities proposed in the alternatives of the Revised Forest Plan.

The amount of roads needed to conduct various management activities were estimated using SPECTRUM. Temporary roads needed to accomplish management activities in the five alternatives ranged from 0.22 to 0.37 miles per square mile per decade. The average of for all alternatives was 0.27 miles per square mile. Permanent road construction ranged from 0.07 to 0.12 miles per square mile and the average value for all alternatives was 0.09 miles per square mile. Road reconstruction ranged from 0.07 to 0.11 miles per square mile and the average value for all alternatives was 0.09 miles per square mile. Road maintenance ranged from 2.20 to 3.65 miles per square mile and the average value for all alternatives was 2.66 miles per square mile.

Estimates for increases over the next 50-year period for all alternatives are:

- Temporary Road Construction – 11.07 to 14.81 miles/square mile
- Permanent Road Construction – 0.37 to 0.49 miles/square mile
- Road Reconstruction – 0.35 to 0.46 miles/square mile
- Road Maintenance – 11.07 to 14.81 miles/square mile

Statistically there are differences among alternatives for these different roads issues, but realistically there are no differences. This can be observed in the range of conditions for the different roads issues. As a result, potential effects on hydrologic modification, riparian health, and sedimentation caused by roads will be similar for all alternatives. In addition, given that standards and guidelines would be the same for all alternatives, all alternatives would be similar. This involves having standards

that address issues like construction of new roads and reconstruction of old roads outside floodplains and riparian areas; construction of all road/stream crossings at a 90-degree angle; and removal of all temporary culverts after forest management. These standards and guidelines give the alternatives consistency.

Cumulative Effects

On non-FS lands, the impact of activities in the watersheds where these species are found could have a long-term impact on species viability. With the spotty distribution of some species, natural or human-caused disturbance could lead to loss of smaller populations. With the distance between some populations and barriers like dams and road crossings in place, species lost to an area from natural or man-made events may have difficulty re-colonizing. This could also affect the host fish of many of the mussel species. As populations decrease and genetic diversity goes down, exotic species (like zebra mussel) have an easier time of out-competing native species. Because of the limited range and isolated populations of some of the species, they are vulnerable to catastrophic events such as accidental toxic chemical spills. These catastrophic events sometimes cannot be expected or planned. The total loss of these species can mean not only the loss of that particular species, but if they are keystone species, it can also lead to the loss of many more species. Given forest-wide and riparian standards, forest management activities may impact individuals of the sensitive species and species of viability concern, but should not lead to a loss of viability for these species. The forest management activities are also not likely to adversely affect populations of federally threatened and endangered species from the viability assessment.

DEMAND SPECIES

Whitetail Deer

Affected Environment

Whitetail deer use a variety of forest types and successional stages to meet their year-round needs. They usually prosper following fire, timber harvest, storms, or other events that produce new vegetation within their feeding range (USFS 1981b). On good sites, forage yields will peak at two to three years after regeneration and then decline for the next five or six years. On poor sites, forage production peaks in three to five years and holds up fairly well for ten years or more (USFS 1981b).

A long-term study that was conducted on the Sylamore Ranger District from 1959-1977 (Rogers et al. 1990) concluded that the carrying capacity of Ozark upland forests is generally low and dependent upon several factors that fluctuate within and among years. Food availability is the most obvious limiting factor and can be manipulated to some extent by management practices. While the amount of summer forage seems adequate to support a moderate population, 85 percent or more of the forage is unavailable during the critical winter period. The problem of forage scarcity is further accentuated by the low nutritional quality. Food plots were shown to be important sources of forage when there were years of low mast production. The

carrying capacity was calculated at about one deer per 45 to 100 acres when the deer subsist solely on native forage. The more forest glade types, the greater the capacity. The Ozarks are described as being suboptimal habitat for deer due to low soil fertility. Mast and fertilized food plots play a more important role in these areas of low fertility; however, deer must also have cover to survive. Thickets, young stands, and other dense vegetation provide escape cover, bedding sites, and fawning areas (Miller and Marchinton 1995).

For the Forests, the preferred habitat for deer can be described as areas of mature hardwood, hardwood-pine, and pine-hardwood stands, which provide hard and soft mast with 0 to 5 year old regeneration areas, food plots, and permanent water sources intermixed. The regeneration areas provide cover and both the regeneration areas and food plots provide browse.

The shift toward an older forest has created trade-offs for the deer nutritionally. The loss of early-successional habitat is somewhat compensated by the increase in mast production potential. The approximately 2,000 acres of food plots and wildlife openings located on the Forests, the increase in the number of acres being prescribed burned, and adjacent private lands further supplement the lack of quality deer forage. Despite this, the amount of cover and foraging areas provided by early seral habitat is declining. Additional adverse effects to deer habitat can be attributed to the drought that the Ozarks has endured the last three years and the related oak decline. The lack of rain further reduced the quality of browse and the effectiveness of the food plots/openings while likely impacting mast production.

During the period of FY 1987-1996, an average of 232 acres of food plots and wildlife openings were developed per year. However, the trend in food plot and wildlife opening development has been decreasing with an average of 61 acres being developed per year during FY 1997-2000. The trend in maintenance of these openings has increased from an average of 411 acres per year being maintained in FY 1987-1996 to an average of 612 acres per year being maintained in FY 1997-2000

Harvest limits and seasons are determined by the AGFC and have changed over the years. In 1967, for example, the gun deer season was split with one week in November and one in December allowing a total limit of two bucks. Presently, the modern gun deer season lasts for approximately 23 days and the limit is 4 deer with no more than 2 bucks. It is obvious that the length of season and limit will greatly influence harvest records, but over time harvest records will reflect population levels. Based on annual harvest data for the 1975-1999 hunting seasons collected by AGFC for the wildlife management areas (WMAs) located within the Forests' boundaries, there is a slight increasing trend in deer harvest with the exception of 2003.

Direct and Indirect Effects

Deer habitat quality and numbers are directly associated with habitat type and condition, successional stage, and the amount of habitat interspersion. The USFS recognizes that deer numbers are generally higher and increased due to the

implementation of projects that increase food production, such as the cutting of trees, prescribed burning, and the development and management of food plots. Conversely, deer populations are usually lower and decline over time from actions that limit the development of early successional habitat and allow the forest to mature, such as the designation of areas with preservation management strategies. The importance of a diversity of hard mast producers, early successional habitat for browse, and permanent openings, with each being well distributed across the landscape to meet the year-round needs of deer, are well known and documented. The effects of each alternative on these key habitat features is discussed in detail in previous sections.

Effects of management options were evaluated for selected MIS demand species using the COMPATS model. This model generates values for each animal that is stated in terms of potential habitat capacity, not actual animal numbers. Habitat capacity reflects the capability of the habitat to support animals under ideal conditions. Actual populations may be lower due to other limiting factors such as poaching, disturbance, or lack of additional supporting habitat. This potential habitat capacity is expressed in numbers of animals per habitat unit, where each unit is 640 acres or one square mile.

It is important to note that COMPATS figures for each alternative are compared to the existing condition (baseline).

Figures 3-9 and Figure 3-10 show these habitat differences between alternatives over a 10-year and 50-year period using a COMPATS model.

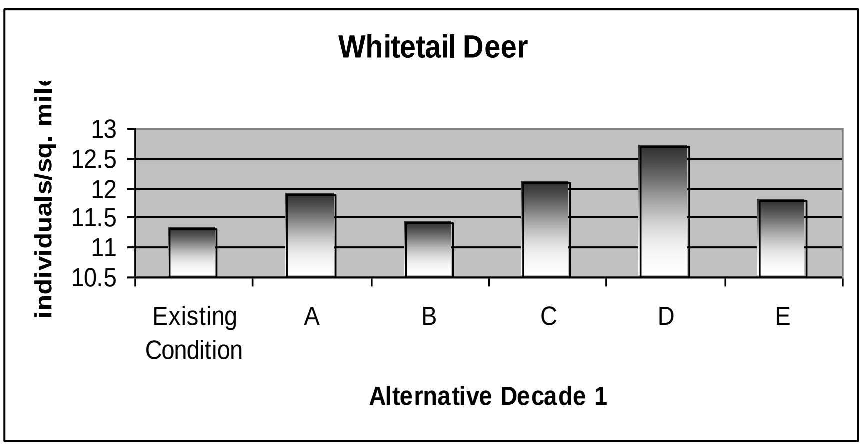

Figure 3-9: 1st Decade Comparison of Whitetail Deer (data gathered from COMPATS Model).

Projected populations of whitetail deer will increase the most with Alternative D and will increase the least with Alternative B over the next decade.

Most early successional habitat would be developed with Alternative D while the least would be developed or maintained in Alternatives B and E. All alternatives provide some early seral habitat as well as a mix of seral conditions across the landscape.

Regeneration tree harvest is appropriate under some other management prescriptions for the improvement of wildlife habitat. Additional deer forage would also be provided through other vegetation manipulations such as the thinning, group selection and prescribed burning of selected areas. These actions not only stimulate browse production but also increase soft mast production from species such as grape and black cherry that are important seasonal foods for deer. The use of prescribed fire will be relied upon heavily to provide a good distribution of browse rejuvenation necessary to maintain quality forage for deer and high quality hunting opportunities for forest visitors.

Hard mast producing species are generally well distributed across the OSFNFs although their success is heavily dependent on weather conditions during flowering. Adequate mast crops occur about every three to five years with heavy crops occurring about every five to eight years. The availability of hard mast is not considered a problem with any plan alternative.

Although the acreages of some type of permanent opening for deer appear sufficient to sustain populations during mast failures, the distribution of this habitat type across the Forests is less than desirable in many cases. Some areas of the Forests have very few permanent openings due to terrain, access, soil conditions, or management prescriptions.

The Forest Service also recognizes that both plant and animal populations can be adversely affected from the overpopulation of deer within an area. Some plants of the families *Liliaceae* (Lily family) and *Orchidaceae* (Orchid family) are preferred as browse for deer. Deer populations commonly increase and exceed the biological carrying capacity (overpopulation) of the area where development of early successional habitat for food and hunting are not allowed. This has never been a problem on the Forests, but if hunting pressure were to significantly drop across the Forests, widespread "overpopulated" deer herds might occur. National Forest System lands have annual hunting to control deer densities. Thus, the hunting of National Forest System lands and the allowance for more liberal taking of deer in Arkansas will prevent overpopulation of these areas and thus prevent the depletion of plant diversity and protect the viability of herbaceous ground flora in these areas.

Cumulative Effects

Figure 3-7 indicates the relative amounts of early successional habitat for browse, mid-late successional forest for mast production, and permanent openings expected over a 50-year period from implementation of various alternatives of the Forest Plan.

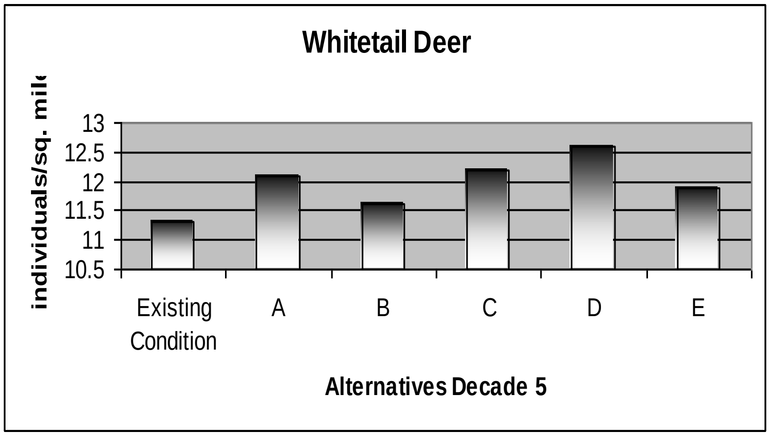

Figure 3-10: 5th Decade Comparison of Whitetail Deer (data gathered from COMPATS Model).

In five decades, Alternative D will still be the highest but increases are smaller over the longer period.

No long-term declines in deer populations are expected under any alternative. The quality of deer hunting opportunities is expected to remain stable over the long-term.

Elk

Affected Environment

Elk are habitat and forage generalists and are very adaptive to various habitats throughout their range. Elk primarily require open areas for feeding and nearby cover for security and temperature regulation. Food habits of elk are variable based on habitat, season, and availability. Elk are ruminant herbivores, capable of grazing and browsing for forage. Cow elk foraging strategy is primarily influenced by security of the elk herd, whereas bull elk foraging strategy is primarily influenced by forage quality. Bull elk remain solitary during most seasons, foraging in small, highly disturbed openings.

Beginning in 1981, the AGFC in cooperation with the National Park Service (NPS) released 105 elk from Colorado and 7 from Nebraska near the Buffalo National River in Newton County. The population has expanded over the years and with a limited draw-permit hunt, this has become one of the major hunting attractions in north central Arkansas. Helicopter counts conducted since 1991 have noted the population expansion from 76 elk counted in 1991 to the current count in 2004 of 266 elk. The AGFC estimated population is 400 to 450 animals.

Possible expansion of elk into new areas outside the Buffalo River corridor will require large-scale habitat enhancement. Habitat on the Forests is characterized as mostly oak-hickory forests with high hard-mast production with little browse or early seral habitat available only on a limited number of maintained food plots scattered over the Forests.

Direct and Indirect Effects

Habitat capability will increase in all alternatives. However, Alternatives B and E specifically provide for habitat for elk on the Forests and encourage landscape scale management of this species. Alternatives B and E will provide quality habitat on approximately 15,700 acres with permanent openings established which would provide much needed winter range for this large species. Disturbance of established populations by OHV use, mountain biking, or horseback riding will be a concern. Areas of the Forest where elk population restoration will take place are relatively remote and less apt to draw the interest of would-be site seers.

The improvement of habitat on FS lands could take some pressure off National Park Service lands along the Buffalo National River and some private lands in the area. There would likely be an improvement in the population distribution with more animals moving south onto forestlands.

Cumulative Effects

Increases in habitat would continue over a 50-year period with an ever-expanding elk population. It is possible that as population number increase across the Forest that some intrusion by unwanted animals on private lands may occur. Currently, the Arkansas Game and Fish Commission handles this problem to some degree with a limited permit hunt in areas where these problems exist.

Eastern Wild Turkey

Affected Environment

Wild turkeys occupy a wide range of habitats with diversified habitats providing optimum conditions (Schroeder 1985). Good turkey habitat is described as mature stands of mixed-hardwoods, groups of sawtimber-sized conifers, relatively open understories, scattered clearings, well-distributed water, reasonable freedom from disturbance, and adequate area (USFS 1980).

During the first few weeks after hatching, turkey poults require large amounts of protein supplied mainly by insects found in grassy openings. These first few weeks are likely the most critical period of the turkey's entire life (Hewitt 1967).

For the southern pine region, Hurst and Dickson (1992) recommended that at least 15 percent of the area should be kept in mature hardwoods such as streamside zones or pine-hardwood corridors. Forest openings and 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.

For the Forests, the preferred habitat for wild turkeys is mature hardwood or hardwood-pine stands with open areas (fields, food plots, or natural openings) nearby and with a permanent water source readily available. Turkeys appear to be widespread on the Forests.

The AGFC compiled harvest records for the WMAs on the Forests for 1975–2000. These records show a generally increasing trend in the number of turkeys harvested with a record harvest of 681 birds in 2000. In addition to harvest records, the AGFC has recorded turkey observations for the Ozarks Physiographic Region since 1992. During June, July, and August, they record turkey observations; the number of turkeys seen, sex, and the number of poults. The average number of turkeys seen per observation has remained fairly stable.

The increase in acres in the older age classes and the consequential increase in the mast capability potential provides an increase in the late-successional habitat for turkeys. The downward trend in early-successional habitat, if continued, will likely produce a negative effect on brood habitat in the future. However, this effect will likely be mitigated somewhat by the thousands of acres of food plots and wildlife openings on the Forests, increased prescribed burning and, in some areas, openings on adjacent private lands. As with deer, the drought and oak decline have a negative effect on turkey habitat.

As discussed for deer, the trend in food plot and wildlife opening construction is declining when compared to the period of FY 1987-1996, but the amount of acres maintained is increasing. At the same time, the trend in pond/waterhole construction is declining with an average of 42 ponds per year for FY 1987-1996, and an average of 20 for FY 1997-2000. The continued construction of seasonal/permanent road closures and waterholes will enhance turkey habitat.

Direct and Indirect Effects

Wild turkeys require a mixture of various 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 (early successional habitat), and herb dominated communities, including permanent openings for brood range. Disturbance may also be a concern during the nesting season in areas heavily used by forest visitors.

Figure 3-11 and Figure 3-12 quantify using a COMPATS model to characterize habitat capability over a 10-year and 50-year period.

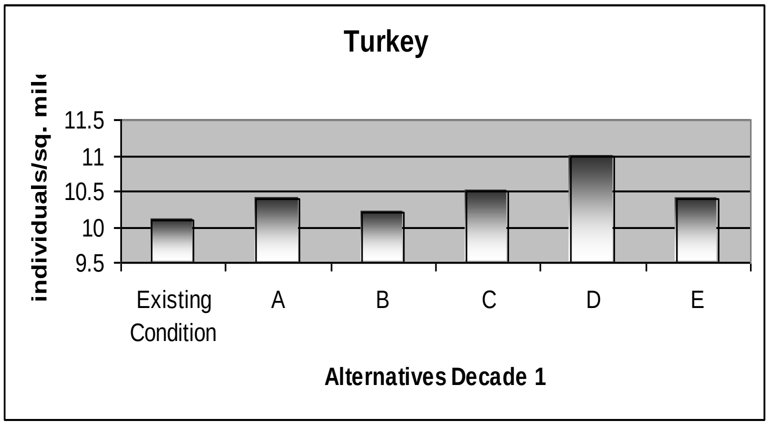

Figure 3-11: 1st Decade Comparison of Wild Turkey (data gathered from COMPATS Model).

All alternatives discussed meet the requirements for turkeys for early successional (shrub) habitats used for nesting over the 10-year period. Habitat capability is highest with Alternative D and lowest with Alternative B.

All alternatives fully meet the desired levels of mast production in total acreage. Distribution of this habitat should not be a problem considering the current distribution and abundance of the oak-hickory forests across the OSFNFs.

The availability of permanent clearings for brood range is the most limiting factor to turkey populations on the Forests. The total acres in openings are not a problem but the distribution of this habitat is. This problem cannot be solved completely because some areas are withheld from active management and this will limit turkey brood range in these areas. Many of the existing areas of permanent openings presently occur as large pastures or where wildlife openings are grouped for maintenance reasons along existing roads. Brood habitat may be provided on adjacent private lands, but this is dependent upon landownership patterns and the vegetational coverage of these lands. Poaching is a serious threat to turkey management within and around the OSFNFs. Turkeys tend to move off large unbroken tracts of mid- to late-successional forest to areas where brood habitat, in the form of permanent clearings, is available. When turkeys move out of the protection of forest cover and onto large open grasslands, such as private pastures, they become more vulnerable to poaching. Open public roads increase this problem.

A combination of vegetation manipulation practices in the form of timber harvest, prescribed burning, pond construction and some new clearing development are included with each alternative addressed. The increased use of prescribed fire will open the understory, improve the sight distance for turkeys, stimulate the growth of legumes and other plants turkeys use for food, and maintain natural grassy savannas that are also used as brood habitat. Prescribed fires result in a mosaic of conditions ranging from very light burn conditions to small, isolated areas of heavy scorch. These small areas of scorch cause tree mortality and open the canopy to allow sunlight to reach the forest floor and results in dense shrub growth that is used for nesting.

Cumulative Effects

Habitat capability will remain stable over the next 50 years. The amount of mid-late successional, mast-producing forest is roughly the same over the 50-year period. Overall turkey populations are expected to remain around current levels over the next 50 years under all management alternatives.

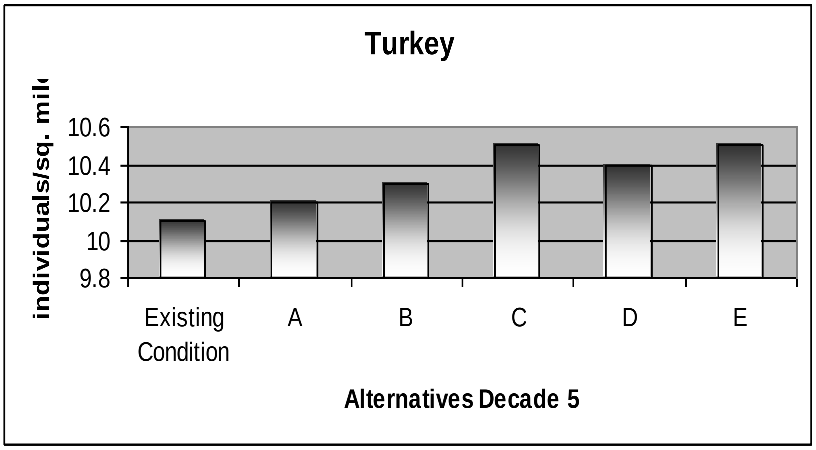

Figure 3-12: 5th Decade Comparison of Wild Turkey (data gathered from COMPATS Model).

In five decades, Alternative C and E will be the highest, but increases compared to the existing condition are still relatively small.

The quality of turkey hunting is expected to remain good, although hunters may have to disperse to other areas of the Forests where more active habitat management is occurring. Turkey hunters are increasing nationally. Such increases in hunters without subsequent, well-distributed increases or stability in turkey populations cause overcrowding and serve to downgrade the sport.

Bobwhite Quail

Affected Environment

Quail are widespread throughout Arkansas yet population numbers are very low. During the last decade the population has continued a steady decline (Fowler, 1992) despite considerable interest and effort directed toward quail population restoration during the past 60 plus years. The Ozark Mountain Region has maintained higher overall population levels when compared with the Delta and Gulf Coastal Plains Regions (Ward, 1999). This is likely due to long-term stability in land-use practices on private lands and contiguous acreage of habitat associated with USFS lands in the Ozark Mountain Region of the state.

Habitat for this species is described as a mix of open ground with grasses and forbs dominant and late seral habitat with cover readily available. Grassy or weedy openings can provide an abundance of insects and weed seed for food. Overhead cover is important to protect birds for avian predators.

Bermuda and fescue pasturelands choke out beneficial weeds and grasses that quail need for food and cover. Recent efforts made over the last four years to convert fescue or Bermuda grass fields and pastures to a mix of native warm-season grasses and forbs will likely improve habitat and foraging opportunities for this once plentiful species.

Limiting factors listed by the AGFC include the overuse of cool-season forages and monoculture hay pastures, the lack of prescribed fire being used, and timber management practices that do not consider providing quality quail habitat (AGFC, Quail Management Plan).

Food plots scattered over the Forests have provided some limited foraging opportunities for this species. In addition, as food plots and opening grow up and brush over, they provide much needed cover for these birds.

Direct and Indirect Effects

Habitat needs for bobwhite quail will improve with each alternative. This species requires quality early seral habitat of which there is little currently provided forest-wide. Increases in thinning, regeneration timber harvest, and prescribed burning will improve habitat on a much larger scale.

Figure 3-13 will quantify quail habitat changes expected with each alternative using a COMPATS model to characterize habitat capability over a 10-year period.

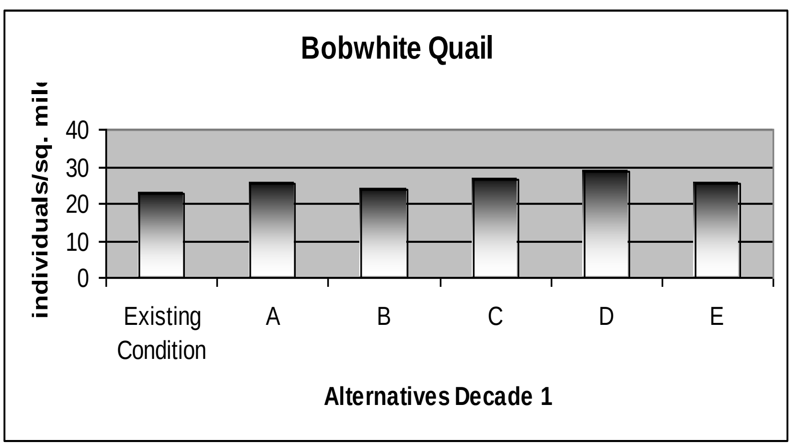

Figure 3-13: 1st Decade Comparison of Bobwhite Quail (data gathered from COMPATS Model).

All alternatives meet the requirements for quail for early succession habitats used for nesting over the 10-year period. Habitat capability is highest with Alternative D and lowest with Alternative B. Increases are small and would take more than the life of this plan to see discernable differences.

The availability of permanent clearings for brood range is the biggest limiting factor to quail populations on the Forests. The total acres in openings are not a problem, but the distribution of this habitat is. This problem cannot be solved completely because

some areas are withheld from active management and this will limit brood range availability in these areas. Many of the existing areas of permanent openings presently occur as large pastures or where wildlife openings are grouped for maintenance reasons along existing roads. Brood habitat may be provided on adjacent private lands, but this is dependent upon landownership patterns and the vegetation coverage of these lands.

Conversion of existing pastures from cool season non-native species such as fescue or persistent warm season grasses like Bermuda grass limit quail use of these areas. Native warm season grass establishment will be encouraged by various forest-wide standards.

The perpetuation of old field habitats and the creation of early successional forest, and increased prescribed burning on the Forests are likely to provide the best benefits to this species. Conversion of selected pasture areas to warm season grasses should also be considered and may be very beneficial toward bringing this species back. Allowing portions of developed wildlife clearings to revert from grass to shrub habitat may also improve habitat conditions.

Cumulative Effects

Cumulatively, trends in habitat quality and quantity on nearby private lands are likely to continue. The increased use of prescribed fire on National Forest System lands is likely the most important effect we may have on quail habitat and their populations. Trends in the short-term (10 years) are expected to continue downward. Long-term trends may show some stabilization as additional habitat becomes more conducive to quail needs. Any increase in overall numbers is not expected to be measurable because such changes in quantity and quality of habitat take a long time to occur. Although the plan improves conditions somewhat, the current decline in quality habitat, as previously described, is likely to continue for this species and others with similar habitat requirements over the life of this plan because of the insufficient amount and inadequate distribution of key habitat condition.

Habitat capability will remain stable over the next 50 years (Figure 3-14). The amount of mid-late successional, mast-producing forest is roughly the same over the 50-year period. Overall bob-white quail populations are expected to remain around current levels over the next 50 years under all management alternatives.

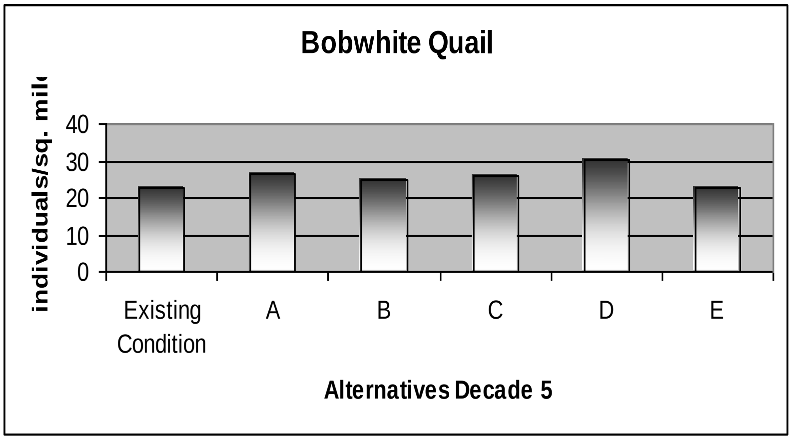

Figure 3-14: 5th Decade Comparison of Bobwhite Quail (data gathered from COMPATS Model).

In five decades, Alternatives A and D will be the highest, but increases compared to the existing condition are still relatively small.

Black Bear

Affected Environment

Bear habitat is described as extensive, rugged country with dense thickets, swamps, bays, or rock outcrops and enough area to travel widely with little contact with man's agriculture and livestock (USFS 1981c). Black bear feed on a wide variety of foods including hard- and soft-mast, insects, animal matter, and succulent plants (USFS 1981c). Early-successional stands provide the high protein foods needed in the post-denning period. Regeneration areas also provide the high-energy food used throughout the breeding season and alternative food sources for fall and winter during years of mast failure. If they are of sufficient size, new stands (5 to 10 years old) also provide excellent escape cover as well as food. Escape cover consists of formidable terrain, thick vegetation, and extensive areas with minimum human disturbance. Because open road conditions can cause a decrease in the amount of escape cover; the number of miles of open roads should be kept to a minimum.

The Forests show thousands of miles of roads on its transportation maps, generally roads can be a negative impact to bears. However, there has been a decline in road construction since 1986 and numerous roads have been closed either seasonally or permanently, helping to improve the quality of habitat for this species.

On the Forests, the preferred habitat for bear can be described as areas that are relatively isolated from disturbance and are comprised of mature hardwood, hardwood-pine, and pine-hardwood forest types that provide hard mast with 0- to 5-year-old regeneration areas and food plots intermixed. The regeneration areas provide cover; the regeneration areas and food plots provide forage and soft mast.

The AGFC compiled harvest records for the WMAs on the Forests for 1980 to present. These records show a generally increasing trend in the number of bears harvested with

a record harvest of 263 in 2002. In addition to harvest records, the AGFC has also collected bait station data from 1985 to present. These record the number of stations visited by bears. This survey reflects a slightly increasing trend in bear visits, which could be showing an increase in bear populations.

Direct and Indirect Effects

Actions of the AGFC, including regulation of hunter harvest and establishment of bear reserves or sanctuaries, are primary influences on bear population levels. However, National Forest management determines habitat features such as levels of public access, levels of vegetation diversity, and availability of mast and den trees.

Availability of potential den trees on the OSFNFs is high in most areas and will not change during the life of this plan. This condition is influenced by past harvest, oak mortality, and the severity and frequency of fire. All alternatives will provide a mix of habitats scattered over the Forests

There will not be a shortage of late successional habitat under any alternative over the next 50 years. Bears also utilize a variety of habitat types, and Alternatives D and B provide for the greatest amount of early successional habitats over the next 10 years.

Mast production is important for bears. As discussed in the "Major Forest Communities Section," oak dominance is likely to decline in many stands due to the lack of capability to treat enough acres to ensure advanced oak regeneration. As the overstory dies, mast capability is reduced. This phenomenon will be more widespread in alternatives that have lower amounts of prescribed fire. Alternatives B and A have low levels of prescribed burning leading to a more severe advanced regeneration problem. Alternative D has a moderate level, helping the situation somewhat. Alternatives E and C burn at levels that should significantly help the situation.

Alternative D is likely to produce compatibility problems for bear habitat conditions due to providing the lowest acreage of unroaded or remote habitat.

Black bear populations are expected to remain viable across the OSFNFs throughout implementation of each of the alternatives.

Cumulative Effects

The status of Arkansas' black bear population is one that is considered growing. Long-term, this will likely continue with some increases in bear populations in some areas over time. Largely, harvest bag limits and public acceptance of this large omnivorous species will determine future populations in the State.

Gray and Fox Squirrels

Affected Environment

The gray and fox squirrels in Arkansas have been recorded as a primary game species for many hunters' quarry as far back as the earliest settlers in the state. These species are found over the entire OSFNFs, and have season and harvest limits set by the AGFC.

Good squirrel habitat is described as a variety of mast-bearing hardwood trees; other tree and shrub species that provide flowers, buds, fruit, and cones in season; and ample den cavities for escape, shelter, and raising young (USFS 1981a). Squirrel reproduction and survival fluctuates with changing yields of heavy-seeded mast-particularly acorns, beechnuts, and hickory nuts (USFS 1981a). The most productive habitat is found in hardwood stands that are between 50 and 100 years old (USFS 1981a). Hedrick (1973) determined that squirrel numbers are directly related to the percent overstory cover of oaks and hickories. Williamson (1983) found that squirrel abundance was significantly correlated with basal area, tree density, and number of oaks per hectare.

For the Forests, mature hardwood stands comprised of various oak species with numerous den trees are the preferred habitat for squirrels. Vast acres of suitable habitat can be found on the OSFNFs.

The increase in mast capability due to the Forests getting older and the probable increase in den trees have provided an increase in habitat for squirrels. As with the other game animals, the drought and oak decline have had a negative effect on gray squirrel habitat. The present and future oak decline/red oak borer problems could have long-term negative effects on squirrel habitat if the oaks are not regenerated and are replaced by shade tolerant species.

Research has shown that squirrel population levels are determined by the quantity of available mast, which is extremely varied from year to year. Squirrel populations generally are the highest in years following a good acorn crop and lowest during years following an acorn crop failure. Healy and Welch (1992) determined that squirrel populations could fluctuate almost 15 fold during a 5-year period within the same unchanged habitat. A wooded area with ample food throughout the year and enough den trees may carry two squirrels per acre.

Squirrel habitat and food availability determine population numbers. Populations have varied greatly over the years but generally, the Forests provide some of the best squirrel habitat and squirrel hunting opportunities found anywhere in the State.

Direct and Indirect Effects

Late seral habitat is projected to increase with each alternative and population trends for this species are expected to remain stable. The alternatives will have very little effect on the squirrel population as a whole because populations are impacted to a

large degree by mast crop failures, droughts, disease, and harvest by hunters,. Late seral habitat will increase in coverage across the Forests over the next 10 years.

Cumulative Effects

Long-term impacts of the alternatives on late seral habitat result in increases in habitat with Alternative B and small decreases in late seral habitat with other alternatives. Implementation of any alternative will have very little impact on squirrel populations.

Stocked Rainbow Trout ("Put-and-Take")

Affected Environment

Catchable size (8 to 12 inches) rainbow trout are stocked by the AGFC in Mirror Lake, which lies just below Blanchard Springs Caverns, and in the White River, which runs along the north and eastern edge of the Sylamore Ranger District near Mountain View, Arkansas. Trout management in Arkansas consists of exploiting coldwater habitats to mitigate the loss of native warm water fish species, and to create recreational angling opportunities. These "Put-and-Take" or "Put-and-Grow" waters provide a coldwater stream fishing opportunity that is unique to the state of Arkansas. The trout fishery plays a major role in fishing popularity and economic importance within the state. According to a 1994 trout angle survey, trout fishing in Arkansas, at that time, generated over 133 million dollars in economic value. 159,665 trout permits were sold during 2001-2002. (AGFC, Trout Management Plan 2004).

Pubic access along the White River is limited to small sections of the river for wade fishermen and at boat access ramps found at Carney, Norfork, Ships Ferry, Calico Rock, and Sylamore along the White River. Mirror Lake is accessed by public walkway and generally has good access opportunities for the fisherman. In 2004, approximately 17,500 catchable size trout will be stocked in Mirror Lake. Based on Arkansas' stocking schedule, most stocked rainbow trout are harvested within a few weeks of their release.

Direct and Indirect Effects

There will be no change in habitat for this species on the Ozark NF. The addition of a Riparian Corridor Management Area (3.I) to all the alternatives, except Alternative A, will add to the protection of the streams during management activities. Forest-wide standards on streamside management, riparian management, and timber harvest will maintain a shaded forest canopy while limiting the amount of sediment running into forest streams. Increases in public use of this fishery can be expected over the next 10 years. Current and future access needs will be met. There would be no direct or indirect effects on the rainbow trout with any of the alternatives.

Cumulative Effects

Long-term impacts of this plan are limited but based on trends over the past 20 to 30 years, it is expected that increased public use of the fishery will continue. Since this fishery is a "put and take" operation typically handled by the Arkansas Game and Fish Commission and the Fish and Wildlife Service, those agencies rather than the Forest Service will control population impacts. Stream habitat quality will remain high on the forest over the next 50 years. There would be no cumulative effects with the implementation of any of the alternatives.

Smallmouth Bass

Affected Environment

Optimal smallmouth bass riverine habitat is described as cool, clear, mid-order streams that are greater than 35 feet wide with abundant shade, cover, and deep pools with moderate current and gravel or rubble substrate.

The aquatic habitats on the Ozark NF have remained in a high quality condition over the years. The EPA Index of Watershed Indicators (IWI) is designed to broadly describe the condition and vulnerability (sensitivity) of aquatic systems across the United States. For the Forest, the watersheds were ranked as either "better water quality, low vulnerability" (highest ranking) or "less serious water quality, low vulnerability" (second highest ranking) (USFS 1999). These rankings demonstrate the high quality of the watersheds and how well they compare to the rest of the nation. Two other studies also confirmed this finding. One was the USGS' National Water-Quality Assessment (NAWQA), and the other was a master's thesis that looked at the headwaters of various streams across the Forest. NAWQA is a program similar to IWI in that it is designed to compare water quality across the country. The Ozark NF was included in a study conducted in the early 1990s that showed water quality in the forested watersheds to be very good (Peterson et al. 1999). The graduate study looked at 10 headwater streams (7 were located on the Forest), to develop a set of indicators to serve as reference conditions upon which to compare other streams (Radwell 2000). While there was a difference in how close each of the seven were to the reference condition, all of the streams displayed attributes of high quality water.

Direct and Indirect Effects

There will be some improvement in habitat for this species on the Forest. Forest-wide standards on streamside management, riparian management, and timber harvest will maintain a shaded forest canopy while limiting the amount of sediment running into forest streams. The addition of a Riparian Corridor Management Area (3.I) to all the alternatives, except Alternative A, will add to the protection of the streams during management activities. Following the emphasis in road crossing design where fish passage will be important, improved fish habitat and increased use of existing habitats might be expected.

Increases in public use of this fishery can be expected over the next 10 years. Current and future access needs will be met. There would be no direct or indirect effects on the smallmouth bass with any of the alternatives. New limits set by Arkansas Game and Fish Commission and supplemental stocking of this species may need to undertaken to maintain population levels if there is an increase in fishing pressure.

Cumulative Effects

Long-term impacts of this plan are limited but based on trends over the past 20 to 30 years. It is expected that increased public use of the fishery will continue. Stream habitat quality will remain high on the Forest over the next 50 years. There would be no cumulative effects with the implementation of any of the alternatives.

Largemouth Bass

Affected Environment

The most popular freshwater game fish in Arkansas, this species has been widely distributed and studied. Optimal largemouth bass habitat is described as clear, quiet waters in natural and manmade lakes and ponds or backwaters and pools of streams and rivers. They are often found in deep water near cover, such as large wood, rock outcroppings, and weed bed structures. They also prefer areas of low turbidity and siltation. The average standing crop in Arkansas lakes is generally less than 100 pounds per acre (Robison and Buchanan 1984). They prefer water temperatures from 77 to 86 °F.

Conditions of the lake can play a large role in the standing crop of bass abundance. Lakes on the Forests range from those that have high productivity (Storm Creek Lake) to others with low productivity (Wedington Lake). Lakes with high productivity have very low water clarity, high nitrogen and phosphorus levels, and high algal biomass. Lakes with low productivity have very high water clarity, low nitrogen and phosphorus levels, and low algal biomass.

Ideally, a well-managed forest reservoir would allow for habitat structure to be added to the system to improve cover for the largemouth bass. In addition, regulation of harvest limits can help maintain a balanced system while supplemental stocking can help maintain optimal population levels (Hobbs et al. 2002).

Direct and Indirect Effects

There will be no change in habitat for this species on the Forests. Forest-wide standards on streamside management, riparian management, and timber harvest will maintain a shaded forest canopy while limiting the amount of sediment running into forest streams and lakes. The addition of a Riparian Corridor Management Area (3.I) to all the alternatives, except Alternative A, will add to the protection of the streams during management activities. Emphasis in lake management and development of lake management plans will serve to direct resources to improve habitat and public access to lakes and rivers across the Forests.

Increases in public use of this fishery can be expected over the next 10 years. There would be no direct or indirect effects on the largemouth bass with any of the alternatives.

Cumulative Effects

Long-term impacts of this plan are limited but based on trends over the past 20 to 30 years. It is expected that increased public use of the fishery will continue. Stream and lake habitat quality will remain high on the Forests over the next 50 years. There would be no cumulative effects with the implementation of any of the alternatives.

Channel Catfish

Affected Environment

The channel catfish is one of the most sought after game and food species in Arkansas. The species has been widely stocked in farm ponds and reservoirs throughout the State. Although its basic habitat is streams, the species is extremely adaptable and is also found in farm ponds, reservoirs, and rivers. It is usually found in deep water (deep pools) around structures (logs and over hanging banks) during the day and moves into the shallower water at night to feed (Robison and Buchanan 1984).

As with largemouth bass, channel catfish standing crop can be impacted by the habitat conditions of the lake. Highly productive lakes, reservoirs, and ponds can have increased biomass at lower levels of the food chain, which can greatly increase the biomass of catfish.

Channel catfish production and numbers can also be improved by increasing the amount of cover available in the system, setting size and number limits for anglers, and having stocking programs available to supplement current populations.

Direct and Indirect Effects

There will be no change in habitat for this species on the Forests. Forest-wide standards on streamside management, riparian management, and timber harvest will maintain a shaded forest canopy while limiting the amount of sediment running into forest streams and lakes. The addition of a Riparian Corridor Management Area (3.I) to all the alternatives, except Alternative A, will add to the protection of the streams during management activities. Emphasis in lake management and development of lake management plans will serve to direct resources to improve habitat and public access to lakes and rivers across the Forests.

Increases in public use of this fishery can be expected over the next 10 years. There would be no direct or indirect effects on the channel catfish with any of the alternatives. New limits set by Arkansas Game and Fish Commission and supplemental stocking of this species may need to be undertaken to maintain population levels if there is an increase in fishing pressure.

Cumulative Effects

Long-term impacts of this plan are limited but based on trends over the past 20 to 30 years. It is expected that increased public use of the fishery will continue. Stream and lake habitat quality will remain high on the Forests over the next 50 years. There would be no cumulative effects with the implementation of any of the alternatives.

MIGRATORY BIRDS

Affected Environment

Habitat fragmentation is a key issue for viability of local populations of breeding birds that are associated with mature deciduous forest interiors (Robbins 1979, Faaborg et al. 1993:35-76, Rosenburg et al. 2003).

Numerous studies have documented that forest interior species may not successfully breed in small patches of otherwise suitable habitat due in large part to adverse effects of forest edge (Faaborg 2003). These adverse effects may include high rates of nest predation (Gates and Geysel 1978, Wilcove 1985, Yahner and Scott 1988), and increased brood parasitism by the brown-headed cowbird (Robinson et al. 1993, Primack 1993, Yahner 1998). However, characteristics of the surrounding landscape, such as percent forest cover and composition of non-forest habitats, determine the magnitude of local edge effects (Faaborg 2003).

Findings of Robinson et al. (1995) indicate that edge effects in large landscapes (approximately 75,000 acres) with at least 70 to 80 percent forest cover are small enough to allow interior bird populations to be productive and viable. As a general rule, parasitism levels of 25 percent or less, and daily nest predation rates of 4 percent or less, should give most forest interior species "at least a chance" (Robinson et al. 1995) of having self-sustaining local populations (see also May and Robinson 1985; Donovan et al. 1995). These conclusions are deemed to generally hold across the eastern U.S. based on a review of nest productivity studies (Faaborg, 2003).

The type of land use creating the opening also may affect the severity of edge effects. Agriculture, pasture, and urban/suburban edges are generally more detrimental to forest interior birds because they support higher populations of nest predators (raccoons, skunks, opossums, crows, and jays) and brown-headed cowbirds, a nest parasite, than do early-successional forest edges. Duguay et al. (2001) found that in a forested setting in West Virginia (Monongahela National Forest with greater than 88% forest cover) "15 years after harvest, cuts placed within otherwise extensively forested areas do not result in the type of edge effects (population sinks) observed in areas fragmented by agriculture in the Midwestern U.S." They also concluded that implementing relatively small cuts that create edge on a small proportion of the landscape might not result in increased nest failure, if other factors such as proximity to cowbird feeding sites are not prominent. The study involved tracking 556 nests of 46 species over a 4-year period and calculation of daily nest survival rates.

Recent research has shown that some edge in forested settings is even beneficial to forest interior birds (Faaborg 2003, Rosenburg et al. 2003). Vega Rivera (1998) and Anders et al. (1998) found that after fledging, juvenile wood thrushes disperse from mature forest habitats and enter early-successional forests where they fed on invertebrates and fruit. Use of these habitats was very high relative to their availability. Later in the season, they shifted back into mature forest habitats. Fledglings preferred areas with dense understory and ground cover with species such as blackberry, sumac, and grape. Such areas may be provided by relatively small even-aged regeneration areas or by smaller dispersed canopy gaps (Rosenburg et al. 2003). Scattered canopy gaps and associated dense understories likely were characteristic of old-growth mesic deciduous forests, providing optimal habitat for these species.

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 USFWS 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.

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.

Considerable information on birds of viability concern was gained through working meetings that included local bird experts with both management and research backgrounds. Information included ranking the importance of major habitat communities used, and special features required in that community.

Because migratory and resident land birds are so varied 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 Final Environmental Impact Statement (FEIS). Effects to specific species of birds are addressed under appropriate sections for

those chosen as Management Indicator Species (MIS). In addition, all relevant conservation priority species, as identified by the USFWS, are assessed under the Terrestrial Species Viability Evaluation.

The Ozark NF falls within the Ozark-Ouachita Physiographic Province (OOPP). The Arkansas River Valley Province is included in the OOPP for PIF planning. Additionally, the Ozark NF falls into the Central Hardwoods Bird Conservation Region (CHBCR).

The St. Francis NF is in the Mississippi Alluvial Valley Physiographic Province and Bird Conservation Region.

PIF Ozark/Ouachita Plan

A Breeding Bird Survey (BBS) analysis looking at all breeding birds in the OOPP indicates that about 20 percent of the species known to breed in the region have declined significantly in the last 37 years. Fifteen percent of the Neotropical Migratory Birds (NTMB) have declined significantly (Sauer et al. 2004).

This same analysis showed that about 10 percent of all breeding birds have shown significant positive trend estimates, while 4 percent of NTMB have shown significant positive trends.

Birds with significant declining trends are loggerhead shrike, common nighthawk, bell's vireo, prairie warbler, lark sparrow, red-headed woodpecker, northern bobwhite, gray catbird, northern flicker, brown thrasher, eastern towhee, field sparrow, orchard oriole, house sparrow, green heron, belted kingfisher, brown-headed cowbird, great crested flycatcher, and blue jay.

Habitat needs of these significantly declining birds show that eight are listed as scrub breeding birds, ten breed in savanna/woodland conditions, five are grassland species, and two use stream or lake habitat. Although analysis of species declining on BBS did not indicate declines in birds using closed canopy forests, the OSFNFs' managers recognize the need to maintain interior forest habitat as well.

Many early-successional species have declined due to forest maturation, fire suppression, reduction of grazing, and low levels of active forest management on federal lands. For information on forest community age classes see the "Major Forest Communities Section."

The impact of the large outbreak of oak decline event on the Ozark NF (300,000+ acres) is not known at this time. There will be a change in bird numbers in these areas but the extent of change is predicted differently in papers presented at a recent symposium dealing with the topic (Smith et al 2004 and James 2004).
Additional information on birds and habitat needs are covered in the "Viability Evaluation Section."

According to the Executive Summary of the Ozark/Ouachita Bird Conservation Plan (Fitzgerald and Pshley 2000), the OOPP is largely blanketed by oak-hickory, oak-pine,

and pine forest ecosystems. Many bird species of PIF conservation priority have centers of abundance in this region. For example, relative abundance data from the BBS indicate that the physiographic area supports over 30 percent of the world's breeding population of whip-poor-wills, over 15 percent of the world's Kentucky warblers and summer tanagers, and over 10 percent of the worm-eating warblers, yellow-billed cuckoos, and Acadian flycatchers. Conservation efforts in the physiographic area have a proportionately greater ability to impact such species as declines or increases in areas with large percentages of a species global population have a greater effect on their global abundance than if similar rates of increase or decline occur where there are fewer individuals. Further, the reproductive success of forest-breeding birds in the Ozark/Ouachitas appears to be above that needed to sustain local populations, and offspring from birds breeding in the physiographic area may be the sources of individuals that colonize other geographic areas where reproductive rates of forest birds are extremely low. Research in the Midwest has shown that such "source-sink" dynamics result primarily from the effects of high levels of brood parasitism and nest predation in areas where forest fragments fall below a size of approximately 4,000 hectares (10,000 acres) or where forest coverage across broad landscapes falls below 70 percent. Therefore, maintaining the forested landscapes needed to support source populations of forest birds is probably the single most important contribution that the physiographic area can make to the conservation of non-game birds.

Several species on the PIF Watch List breed in the physiographic area. Although the Ozark/Ouachitas are not necessarily the center of abundance for most of these species, all were once much more abundant and widely distributed in the region than they are today. Three of these are species associated with pine savannas (red-cockaded woodpecker, brown-headed nuthatch, and Bachman's sparrow) and three with bottomland hardwood forests (prothonotary warbler, cerulean warbler, and Swainson's warbler). Because these species have undergone drastic range-wide declines, PIF feels that active restoration and management of those habitats across their range is warranted.

A number of species of concern that have declined significantly in the physiographic area are associated with grass-shrub or early-successional forest (e.g., northern bobwhite, brown thrasher, prairie warbler, field sparrow, and orchard oriole). Idling agricultural lands, even-aged timber management, or restoration of glade and savanna habitats can provide for these species. However, decisions about fire intervals and other management techniques for glades and savannas should take into account the need of these birds for scattered trees or shrubs. Acreage needs of early-successional species must be balanced with the needs of mature forest species also in need of conservation attention.

Habitat conservation strategies suggested in the PIF plan vary among subdivisions of the physiographic area, and are based upon present day or projected patterns of bird distribution, land use, land cover, ownership, etc. Suggested conservation strategies for each subdivision of the physiographic area are given at the end of the habitat objectives section. In general, recommendations focus on maintaining the region's largely forested landscapes and large blocks of forest to keep source populations

intact, restoring landscapes or blocks where potential currently exists, and balancing forest age classes within those areas so that the needs of species requiring a variety of successional stages all can be met.

Cerulean Warbler

The cerulean warbler is a species of concern that merits a special evaluation. It is a species currently under review for designation as threatened or endangered under the Endangered Species Act. Its habitat needs are unique and still being evaluated. Breeding cerulean warblers prefer, and are most common in, large contiguous forested tracts (Hamel 1992). In general their habitat is mature or over-mature, high site, hardwood forest with a complex canopy structure. Large trees protruding above the rest of the canopy are favored. A developed understory also appears to be important (*Personal Communication.* C. Kelner.). The OSFNFs are on the edge of this species range and they only use a percentage of the stands meeting the above criteria. It is not known if the population is a source or sink population (*Personal Communication.* C. Kelner).

The cerulean warbler population on Ozark NF has been documented by several sources. Dr. Chris Kelner of Arkansas Tech University is currently doing extensive research on the species and its breeding habitat on the Forests.

There are differing views on the effect of oak decline, silvicultural treatments, and effects of burning on this species. Effects of prescribed fire are of special concern locally and should be monitored closely.

Although mature forest with a canopy is clearly a requirement, several sources indicate that birds tolerate or respond positively to canopy caps. Noting several sources, Hamel (2000 and references therein) indicated, "gaps in the canopy or openings are important to the distribution of birds." (*Personal Communication.* R. Tallman) suggests that birds on steep slopes in West Virginia use the "edges" created by tall trees that emerge from canopy gaps from cutting or windthrow. In the Missouri Ozarks, birds similarly use taller trees, group selection cuts, and breaks in the canopy next to rivers. All appear to create structurally similar gaps or microhabitat "edges" that result in use by cerulean warblers (Burhans et al. 2002). Several forests reported use of small openings, canopy gaps, and areas with a history of logging and disturbance (Burhans et. al. 2002).

This NTMB winters in evergreen forests of the eastern slope of the Andean Foothills (Evans and Fischer. 1997). Tropical deforestation may threaten the Cerulean more than any Neotropical migrant because of its dependence on this limited habitat type (Flaspohler. 1993). Habitat loss in this area has been extensive in the past 10 to 15 years, and the area is reported to be one of the most intensively developed (e.g., logged, cultivated) regions in the Neotropics (Robbins et al. 1992).

Mississippi Alluvial Valley Plan

The major bird conservation issue in the Mississippi Alluvial Valley (MAV) is reforestation of lands that have been cleared for agriculture. The plan promotes reforestation to produce large enough forest blocks to be ecologically functional for priority bird species.

Direction and goals given for Crowley's Ridge include maintaining existing oak-hickory forest and managing vegetation to promote structural diversity.

One bird of particular importance on the St. Francis NF is the Swainson's warbler. This bird has the highest PIF score of all species evaluated for the MAV and is ranked higher than any other species occurring on the Ozark NF as well. It is found in patches of giant cane and in young even-aged stands. Dr. Gary Graves, with the Smithsonian Institution, has studied this species on the St. Francis NF. Dr. Graves describes the Swainson's warblers breeding territories as characterized by extensive understory thickets, frequent greenbriar tangles, deep shade at ground level, and an abundance of leaf litter overlying moist organic soils. He further reported that data suggest a preference for early-successional forest in the landscape or disturbance in primeval forest. Dr. Graves recommends short rotation even-aged management to obtain robust populations of this species (*Personal Communication*. Graves. 2004). Recently, the Swainson's' warbler has been found on the St. Francis NF most often along the interface between floodplains and upland forest (Cannon. 2001).

Direct and Indirect Effects

The evaluation of effects on birds will, for the most part, focus on birds of conservation concern. Local bird experts representing a variety of agencies and universities developed information in the Species Viability Evaluation (SVE). These experts helped develop the list of birds to evaluate, the habitats and habitat features the birds' need, and effects management or lack of management has on these species. For this section, birds are discussed by the type of vegetation they require.

Glades

All alternatives will maintain glades. This will benefit a variety of birds that presently are restricted in the planning area due to overgrown habitat conditions. Birds benefiting from this maintenance include northern bobwhite, rufous-crowned sparrow, and painted buntings as well as more common species such as field sparrows. Birds that could be affected negatively by this maintenance include the cedar waxwing, although it currently is not listed as a species of conservation concern.

Since little maintenance of this habitat is expected on private lands, maintenance on FS lands is considered very important for species needing maintained glades.

Oak Woodland and Savanna

Restoration of oak woodlands and savanna habitat will benefit several species of concern such as northern bobwhite, red-headed woodpecker, Bewick's wren, Bachman's sparrow, prairie warbler and, to a lesser extent, American kestrel, painted bunting, and orchard oriole. More common birds such as northern flicker, red-tailed hawk, and eastern bluebird will also benefit.

Detrimental effects from the planned level of restoration will have minimal effects on species of concern (see Table 3-120). The All Bird Plan for the Central Hardwoods Bird Conservation Area supports oak woodland and savanna restoration as a strategy for conserving birds in the conservation area.

Table 3-120: Projected Acres of Dry-Oak Woodland Condition by Alternative at Decade 1/Decade 5.

Decade	Current	Alternatives				
		A	B	C	D	E
	300					
1		500	700	22,00	300	22,000
5		1,300	2,200	110,000	500	116,000

Since little maintenance of this habitat type is expected on private lands, maintenance on FS lands is considered very important for species needing maintained oak woodland and savanna community types.

Alternatives C and E attempt to restore oak woodland condition on a significant portion of the land within the dry oak forest and woodland ecological classification. For the first decade, predicted in oak woodlands produced 17,838 acres, in Alternative C and 16,466 acres in Alternative D. This is an improvement over current conditions on the ground but is far short of the desired future conditions for full implementation of these alternatives.

By the fifth decade, acreages increase to 87,891 for Alterative C and 81,162 acres in Alternative D. This level of restoration would provide significant increases for species needing this type of habitat.

Alternatives A, B, and D predicted little to no production of oak woodland habitat. At the end of five decades, Alternative A produced 1,221 acres; Alternative B produced 2,266 acres; and Alternative D produced 472 acres of oak woodland.

Pine Woodlands (Pine-Bluestem)

Restoration of pine woodlands will benefit brown-headed nuthatch, Bachman's sparrow, prairie warbler, redheaded woodpecker, and northern bobwhite. This habitat type also historically provided for the endangered red-cockaded woodpecker. More

common species benefiting for this community include pine warbler and Carolina chickadee. The All Bird Plan also supports restoration of this habitat to conserve bird diversity of this region.

Restoration at the scale planned in alternatives for this FEIS is not expected to cause problems for any current species of concern.

Since little maintenance of pine-bluestem is expected on private lands, maintenance on national forest lands is considered very important for species needing maintained pine-bluestem community type. Table 3-121 indicates the projected levels of Pine Woodland condition.

Table 3-121: Projected Acres of Pine Woodland Condition by Alternative at Decade 1/Decade 5.

Decade	Current	Alternatives				
		A	B	C	D	E
	5,300					
1		10,200	9,400	20,300	8,600	19,500
5		29,800	25,900	100,100	21,800	99,500

Alternative A produces 10,209 acres of pine-woodland the first decade while Alternative B produces 9,421 and Alternative D produce 8,580 acres. By the end of the fifth decade, Alternative A produces 29,799 acres; Alternative B produces 25,861 acres; and Alternative D produces 21,775 acres. These levels of production show little progress in providing this important habitat type.

Alternatives C and E attempt to restore pine-woodland condition on a significant portion of Ozark NF. Approximately 20,300 acres of pine-woodland condition are being created in the first decade of Alternative C and 19,500 acres in Alternative E. By the end of the fifth decade, models predict over 100,000 acres of pine-woodland in Alternative C and near that amount in Alternative E. These levels show a significant improvement for birds tied to pine-woodland habitat. The other alternatives show some increase in acreage of this habitat, but at much lower levels.

Early-Successional Habitat

The early-successional phase (age 0 to 10) of forest types on the OSFNFs is important for many priority bird species. They will be discussed here and discussion of forest types will focus on mid and late seral stages for the forest type.

Early-successional forest condition provides for grassland/shrub land priority birds such as white-eyed vireo, blue-winged warbler, northern bobwhite, and chestnut-sided warbler. More common but declining birds associated with this condition include brown thrasher and field sparrow. Riparian early seral is important for American woodcock, orchard oriole, and ruffed grouse.

Planned levels of regeneration that include a protective streamside management zone should not detrimentally affect any priority bird species.

Table 3-122: Acres of Early-Successional Habitat by Alternative at Decade 1/ Decade 5.

Decade	Current	Alternatives				
		A	B	C	D	E
	47,713					
1		51,040	43,538	46,789	58,469	43,612
5		55,639	48,841	51,168	64,227	47,218

Acres of early-successional habitat vary by alternative as indicated in Table 3-122. In the first decade, regeneration acres produced are 51,040 in Alternative A; 43,538 in Alternative B; 46,789 for Alternative C; 58,469 for Alternative D; and 43,612 for Alternative E. The fifth decade regeneration levels are 55,639 in Alternative A; 48,841 in Alternative B; 51,168 for Alternative C; 64,227 for Alternative D; and 47,218 for Alternative E. These levels are all short of recommended levels to provide a steady flow of early seral habitat to maintain the native forest types of the region and provide a mix of seral stages for associated species.

Regeneration levels to sustain current forest communities on the OSFNFs and to provide the viability needs for the varied species vary per decade by forest type. Recommended regeneration levels range from 5 to 10 percent for mesic hardwood associations to 10 to 15 percent for dry pine and oak types (Ozark-St Francis SVE).

Mid- and Late-Seral Forest Types

Dry oak, mesic hardwood, and pine forest types will be discussed. Many of the birds associated with these types are considered interior forest species that are sensitive to forest fragmentation. With the ratio of forest to farmland associated with the fragmentation of the Ozark NF, this not considered to be an issue.

Forest fragmentation on the St. Francis NF could be affecting interior bird productivity but to date no known productivity studies have been done. It is known that interior bird species are plentiful on the St. Francis NF.

Although it is important for many of the common species, dense or semi-open pine forest is not listed as optimal for any bird species of concern. As discussed earlier, when this type is in regeneration or in woodland condition, it benefits many species of concern.

Mid- to late-seral dry oak forests are optimal for Chuck-will's-widow and whip-poor-wills. Both of these species require clearings near by.

Mesic hardwood forests are also listed as optimal for Chuck-will's-widow and whip-poor-will, chimney swifts, Acadian flycatcher, wood thrush, worm-eating warbler, and hooded warbler. Chimney swifts require large hollow trees.

Two other birds of particular concern require mesic portion of dry-mesic forests. The cerulean warbler requires large timber with emergent trees. Designation of cerulean

warbler as a MIS will assure that this species and its habitat are given special attention in plan implementation. Managing timber in occupied and potential cerulean warbler habitat will require providing for short term and long -term habitat needs. To analyze effects of alternatives on cerulean warbler habitat, the amount of forest on site index 70 and above lands that are at least 70 years old were tracked for each alternative. In addition, the amount of these forests with canopy gaps, a condition preferred by this species, was also estimated. Results of this analysis are presented in the Management Indicator Species section of this document.

Increased fire may have detrimental effects on this species. Many of the acres burned are repeat burns to provide ecological conditions or maintain fire fuel goals. In doing so that leaves other non- targeted areas unburned. It is projected that over 50 percent of the cerulean warbler sites would be unburned for any alternative during the planning period. This will allow for evaluation of effects of burning on this MIS over the next decade.

The Swainson's warbler, also of particular concern, requires canebrakes (considered a rare habitat), which are to be restored in all alternatives, and early seral hardwood forest on very productive sites (such as the lower slope of Crowley's Ridge). All alternatives should provide this habitat.

Maintenance of native forest conditions on OSFNFs is thought to be very important to native wildlife including interior bird species. Pine and oak forests have been in place for the last 4,000 to 6,000 years. It is important to produce new stands of similar timber to replace the old stands. If this is not done, native birds and other animals are faced with habitats they may not be adapted to. As discussed in the "Forest Health" and "Historical Perspective" sections, hardwood stands on the Forests are much denser today than in the past. This, along with a reduction in historic levels of fire, has produced conditions unlikely to adequately regenerate new stands of oak forests. With the oak stands on the Forests stressed due to overstocked conditions and old age, oak forests are dying faster than they can be regenerated. This situation recently converted hundreds of thousands of acres to shade-tolerant species such as red maple stands that have never been prominent in the Ozarks. The effects this will have on bird species in the short and long term are not known. Predictions of the effects have been varied. The most widely accepted opinion is that it is more desirable to regenerate pine forests to pine and oak forest to oak stands similar in composition to forests that have been prominent for the last 4,000 to 6,000 years.

Fire has played an important role in maintaining the native forest types on the OSFNFs. Prescribed fire levels that mimic historic fire frequencies and intensities should help maintain these timber types and forest structural conditions to which the native birds are adapted. High intensity fires are dangerous in today's environment and are mimicked by cutting timber in ways that thin or regenerate our native forests. Over the last 90 years, reduced fire and low levels of silvicultural activities, which produce the same effect, have resulted in forest conditions that are out of balance. An overabundance of older stands is present with few young or medium aged stands.

Another way to analyze effects is to look at perpetuation of important forest types that native birds depend on.

Cumulative Effects

An analysis of Table 2-21 (Page 2-32) shows that the level of pine regeneration in each alternative leads to a healthy mix of age classes in the fifth decade. These levels of regeneration should sustain the forest type and provide for early and late seral associates.

The mix of hardwood age classes is unbalanced for all alternatives and should lead to a change of hardwood types from shade-intolerant types (that have dominated the landscape for several thousand years) to shade-tolerant species, especially on the more productive sites. Dryer sites will probably remain oak dominated. Alternatives C and E provide prescribed burning levels that may help promote oak regeneration underneath current stands and allow oak to replace the older stands as the overstory dies.

As stated before, the effects of this conversion are not fully understood yet. Many interior bird species may fare well while others, that are more dependent on oak types, will suffer.

FOREST INSECTS, DISEASES, AND INVASIVE PLANTS

Affected Environment

A multitude of species including native and non-native plants, insects, and pathogens threaten the integrity of native ecosystems on the OSFNFs. Certain introduced and native species of plants, animals, and other organisms threaten forest resources as competitors for living space, disease-causing agents, or aggressive consumers of plants. Damage to forest communities occurs in varying degrees depending on community type, species composition, location on the landscape, age of the forested community, past disturbance, stress factors, and weather conditions.

The OSFNFs have identified particular forest health concerns that threaten its 1.2 million acres either directly or indirectly. These threats are categorized as: non-native invasive plants, native diseases, non-native insects, native insects, and other threats. Threats to specific species within these categories are identified in more detail below. Currently, the biggest concern to forest health is oak decline. The recent epidemic of red oak borer, an oak decline related insect, has proven destructive to some of our most valued oak/hickory stands.

Non-Native Invasive Plant Species (NIS)

The USDA Forest Service *Southern Regional Strategy for Noxious Weed Management* states that a species is considered a non-native invasive if; 1) it is not native (i.e., alien) to the ecosystem under consideration, and 2) its introduction causes or is likely to cause economic or environmental harm or harm to human health. There are a large number of invasive and exotic plants affecting forest health, primarily by replacing native species and reducing native plant biodiversity. The Regional Forester maintains a list of these species. Species from the Regional Forester's list that are found in Arkansas or that pose a threat to Arkansas ecosystems are identified in Table 3-123. Also included in Table 3-123 are species of concern from the Arkansas Heritage Commission. Inclusion of a species on the list is not a certification that it is known to occur in Arkansas or on national forest lands. However, this list informs FS personnel about these species as likely threats and heightens the awareness that these species may be present on the Forests. These "weed" species are divided into the following three categories:

Category 1 Species. These are non-native plant species that are known to be invasive and persistent throughout all or most of their range within the Southern Region. They can spread into and persist in native plant communities and displace native plant species; therefore, posing a demonstrable threat to the integrity of the natural plant communities in the Region. The use of Category 1 Species for the purposes of revegetating or rehabilitating sites is prohibited on National Forest System Lands. Cooperators and partners may not establish or encourage Category 1 Species for any reason in projects that receive Forest Service funding except in the furtherance of projects, memorandums of understanding (MOUs), and memorandums of agreement (MOAs) that were already in effect on the date of issuance of the Regional Exotic Invasive Plant Species List, or as required for scientific studies designed to further knowledge about invasive species. Efforts to control Category 1 Species are encouraged where practicable. Proposals for non-native invasive plant species control will receive the highest funding priority when they include Category 1 Species, particularly where native plant communities are threatened.

Category 2 Species. These are non-native plant species that are suspected to be invasive or are known to be invasive in limited areas of the Southern Region. Category 2 Species will typically persist in the environment for long periods once established, and may become invasive under favorable conditions. Plant species in Category 2 pose a significant risk to the integrity of natural plant communities throughout the Region or in parts of the Region. The establishment or encouragement of Category 2 Species is prohibited in areas where ecological conditions would favor invasiveness and is discouraged elsewhere. Projects that use Category 2 Species should document why no other (non-invasive, non-native, or native) species will serve the purpose and need. Cooperators and partners are also discouraged from using Category 2 Species. The Forests' botanist, plant ecologist, noxious weed coordinator, Regional specialists should be consulted for alternative native or non-invasive non-native species that would serve the purpose and need of the project. Control efforts for Category 2 Species may or may not be necessary to achieve the management objectives of the planning area.

Category 3 Species. These are non-native plant species that are suspected to be invasive or are known to be invasive in Arkansas but are not currently on the Regional Forester's list. These species are recognized by the Arkansas Heritage Commission as being a current or potential threat to lands in Arkansas.

Table 3-123: Invasive Plant Species Threatening the OSFNFs.

Scientific Name	Common Name(s)	Habitat	Comments	Species Category
Ailanthus altisimma	Tree of heaven	Windthrow gaps, roadsides, open woods	Increasing in Ozarks. Benefits from disturbance.	**1**
Albizia julibrissin	Silktree Mimosa	Roadsides, stream banks, windthrow, old fields	Common. Benefits from disturbance.	1
Alliaria petiolata	Garlic mustard	Mesic woods, floodplains,	Tolerates shade. Dispersed by hikers, vehicles, ATVs, & wildlife.	1
Ampelopsis brevipedunculata	Porcelainberry	Mesic woods, streamside, lake margins	Collected in 2003 from fluctuation zone around Beaver Lake in Benton County.	2
Arthraxon hispidus	Carpgrass	Wet areas in pastures & prairies, roadside ditches, and along streams	Benefits from ground disturbance. Does well on moist soils. Spread by mowing.	2
Bromus spp.	Cheatgrass Bromegrass Chess	Roadsides, glades, rocky open woodlands	Common in Ozarks. Spread by mowing & ground disturbance. Native species in Arkansas are *B. pubescens* & *B. nottowayanus*. All others are potential invasives.	2

Table 3-123: Invasive Plant Species Threatening the OSFNFs. (Continued)

Scientific Name	Common Name(s)	Habitat	Comments	Species Category
Carduus nutans	Nodding thistle Musk thistle	Roadsides, glades, pastures, old fields	Spreading rapidly in Ozarks. Mowing is a likely vector.	2
Celastrus orbiculatus	Oriental bittersweet	Forest edges, disturbed woods	Common around Fayetteville, but likely to spread. Probably dispersed by birds.	1
Centaurea beibersteinii (incl. C. maculosa and C. stoebe)	Spotted knapweed Russian knapweed	Roadsides, glades, prairies, pastures, old fields	Now common and spreading in NW Arkansas. Certainly spread by mowing along roads. Has well-documented allelopathic properties.	2
Coronilla varia	Crown vetch	Roadsides	Common on top of Mount Magazine. Found on Sylamore RD. Out-competes native species.	2
Leucanthemum vulgare (= Chrysanthemum leucanthemum)	Ox eye daisy	Roadsides, prairies, pastures, old fields	Very weedy at Baker Prairie Natural Area in Boone County and across Ozarks along roads and pastures. Spread by mowing.	3
Cynodon dactylon	Bermuda grass	Occasionally in glades and prairies	Not a major problem, but hard to eradicate if unwanted.	3
Dioscorea oppositifolia (=D. batatas)	Air potato	Mesic woods, edges	Benefits from disturbance	1
Dipsacus fullonum	Teasel	Roadsides, old fields	Spreading rapidly along roads in the Ozarks	3
Elaeagnus spp. (E. umbellata, E. pungens, E. angustifolia)	Russian olive Thorny olive Autumn olive	Forest edge, along streams	*E. umbellata* and *E. pungens* are naturalized widely in Arkansas. Both were planted for wildlife in the past.	1 & 2

Table 3-123: Invasive Plant Species Threatening the OSFNFs. (Continued)

Scientific Name	Common Name(s)	Habitat	Comments	Species Category
Eragrostis curvula	Weeping lovegrass	Roadsides, glades, rocky open areas	Planted along roadsides. Does well in thin soils. Invades glades. Spread by mowing.	2
Euonymus fortunei	Wintercreeper Euonymus	Mesic woods	Problem on many NW Arkansas natural areas. Covers ground (evergreen). Flowers & fruits when it climbs trees. Probably dispersed by birds.	1
Festuca arundinacea (a.k.a Lolium arundinaceum)	Tall fescue	Roadsides, prairies, pastures, old fields	Invades prairies and is difficult to eradicate. Spread by mowing & water flow. Declines with repeated fire.	3
Glechoma hederacea	Ground ivy	Stream terraces	Dominant on periodically flooded, shaded terraces of Buffalo National River in Newton Co. Also found on Sylamore RD.	3
Hedera helix	English ivy	Woods	Thick in areas at Pea Ridge National Park. Probably planted. Not hard to eradicate with herbicide.	2
Holcus lanatus	Velvetgrass	Prairies, old fields, pastures	Major problem at Chesney Prairie Natural Area in Benton Co. Very difficult to eradicate. Spread by mowing & water flow.	3
Lespedeza bicolor	Bicolor lespedeza Shrubby lespedeza	Roadsides	Persists & spreads. Out-competes native vegetation.	3
Lespedeza cuneata	Sericea lespedeza	Roadsides, glades, prairies, pastures	Invades open habitat. Very difficult to eradicate.	1

Table 3-123: Invasive Plant Species Threatening the OSFNFs. (Continued)

Scientific Name	Common Name(s)	Habitat	Comments	Species Category
Ligustrum sinens (& L. vulgare)	Privet	Mesic woods, prairies, margins of glades, stream corridors	Major problem in Arkansas. Spread by birds. Can be controlled by cutting & treating stumps with herbicide	1
Lonicera japonica	Japanese honeysuckle	All habitats	Major problem in Arkansas. Out-competes native vegetation in variety of habitats. Repeated fire will control.	1
Lonicera maackii	Bush honeysuckle Shrub honeysuckle	Forest edge, mesic woods, dry woods, glades	Very common around Fayetteville & Springdale. Spreading. Seems to like calcareous soils. Excludes all herbaceous plants when it forms dense thickets.	1
Lythrum salicaria	Purple loosestrife	Wetlands	Known from Ozarks. Needs to be watched for.	1
Melia azedarach	Chinaberry	Forest edge, pastures, old fields	Scattered in Ozarks.	2
Melilotus alba (& M. officinalis)	White sweetclover	Roadsides, pastures, glades, prairies, open areas, woodlands	Major problem in some glade areas. Appears to like calcareous soils.	3
Microstegium vimineum	Japanese stiltgrass Nepalese browntop	Mesic woods, stream corridors	Spreading extremely rapidly. Probably in every Ozark county and major watershed. Capable of displacing all native herbaceous vegetation on stream terraces. Spread by water flow & mowing.	1
Paulownia tomentosa	Princess tree Empress tree	Forest edge, windthrow gaps, pastures, old fields	Infrequent but increasing in Arkansas Ozarks.	3

Table 3-123: Invasive Plant Species Threatening the OSFNFs. (Continued)

Scientific Name	Common Name(s)	Habitat	Comments	Species Category
Perilla frutescens	Beefsteak plant	Open woods, roadsides, floodplains of streams, pastures, etc.	Common on Sylamore RD. Benefits from road construction, soil disturbance.	3
Pueraria montana	Kudzu	Forest edges, roadsides, pastures, & adjacent areas.	Increasing all the time from old plantings, etc.	1
Pyrus calleryana	Callery pear	Forest edges, roadsides, clearings, open woods, pastures, windthrow gaps	Rootstock for many grafted ornamental pear trees (including "Bradford"). Suckers rapidly produce fertile seeds that are dispersed by birds. Very aggressive.	3
Rosa multiflora	Multiflora rose	Forest edges, roadsides, clearings, pastures, old fields, prairies, windthrow gaps, stream corridors	Spread by birds.	1
Sorghum halepense	Johnson grass	Forest edge, roadsides, pastures, old fields, prairies, margins of glades	Benefits from soil disturbance.	1
Vinca major (& V. minor)	Periwinkle	Forest edges, roadsides, old fields, etc.	Spreads from old plantings, home sites, etc. Out-competes all other herbaceous plants.	3
Wisteria sinense (& possibly W. floribunda)	Chinese wisteria	Forest edge, old fields, pastures, etc.	Spreads from old plantings, home sites, etc. Can choke out trees, damage buildings, etc.	2

Direct, Indirect, and Cumulative Effects

In 1999 the Southern Region released a Noxious Weed Management Strategy that outlines 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 Non-Native Invasive Plant Species List (See Category 1 & 2 Species in Table 3-123). Because of the potential threat to native forest communities, Species Category 1 are prohibited from use for the purpose of revegetating or rehabilitating land within the National Forest System. The use of Category 2 Species is prohibited from use in areas where the ecological conditions favor invasion and are discouraged is all other areas.

Even with precautions in place and an emphasis on invasive species eradication, the threat to National Forest System lands from outside sources is real and imminent.

No single set of environmental conditions could adequately predict trends in such a large group of plants. The two key variables are:

- The probability of introduction, and
- The probability of establishment once a plant is introduced.

Introduction may be natural, intentional, non-intentional, or human caused. Increases in the number of people visiting the national forests and increases in the number of residences in close proximity to the national forests also increase the chance of invasive species introductions. However, the probability of establishment for most of the currently recognized species is increased when introduction coincides with disturbance that provides receptive conditions, such as bare soil and strong sunlight. Non-native invasive species would, therefore, be generally favored with any increase in ground disturbance within alternatives. All alternatives are expected to provide moderate levels of forest management and are not expected to effect non-native invasive species differently. The OSFNFs will emphasis non-native invasive species eradication equally throughout all alternatives.

The number of invasive plant species can be expected to increase due to natural spread and inadvertent introduction by transport of goods and/or by persons in all ownership categories.

Native Diseases

Oak Decline

Affected Environment

Oak decline is a complex native disease involving interactions between environmental and biological stresses and subsequent attacks by insects and pathogens of opportunity. The disease generally progresses slowly over several years. It begins with a long-term predisposing stress such as prolonged drought, advanced age, or excessive stand densities. 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, the trees are vulnerable to attack by insects and diseases that would normally not invade healthy trees. Once stressed trees are invaded, classic decline symptoms appear, beginning as dieback from the branch tips inward. Ultimately, the effects of decline result in the death of the tree.

Decline and mortality of oaks have been recorded in the eastern United States since the early 1900s (OOHA, Rpt. 5. 1999). Oak decline is known to occur all over the eastern United States in susceptible oak forest types. Species in the red oak group, such as northern red oak (*Quercus rubra*) and black oak (*Quercus velutina*), are more likely to die of oak decline, while white oaks (*Quercus alba*, etc.) are less likely. Hickories (*Carya spp.*) are the only species other than oaks to show decline symptoms (OOHA, Rpt 5. 1999). Tree mortality occurs from a combination of factors including, but not limited to, armillaria root rot (*Armillaria mellea*), twolined chestnut borer (*Agrilus bilineatus*), hypoxylon cankers, grasshoppers, walking sticks, carpenter worms, oak worms, and red and white oak borers (*Goes tigrinus*).

The OSFNFs contain approximately 760,000 (66% of total land base) acres of hardwood forests dominated by oak forest types, the majority of which are susceptible to oak decline (Figure 3-15).

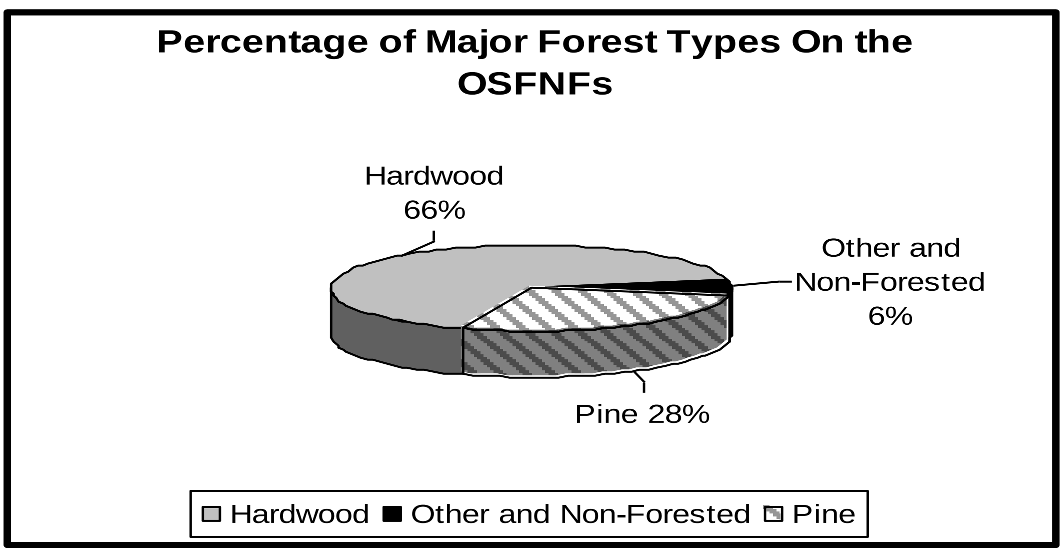

Figure 3-15: Major Forest Types.

Due to low levels of reproduction cutting and active management within the OSFNFs in recent decades, stands have been allowed to accumulate excessive stand densities and age, therefore, creating an unbalanced age-class distribution (Figure 3-16). Prior to 2000, 92 percent of the hardwood acres were considered mature (50 years old and greater). As a result, 705,000 acres of the OSFNFs were considered highly vulnerable to oak decline.

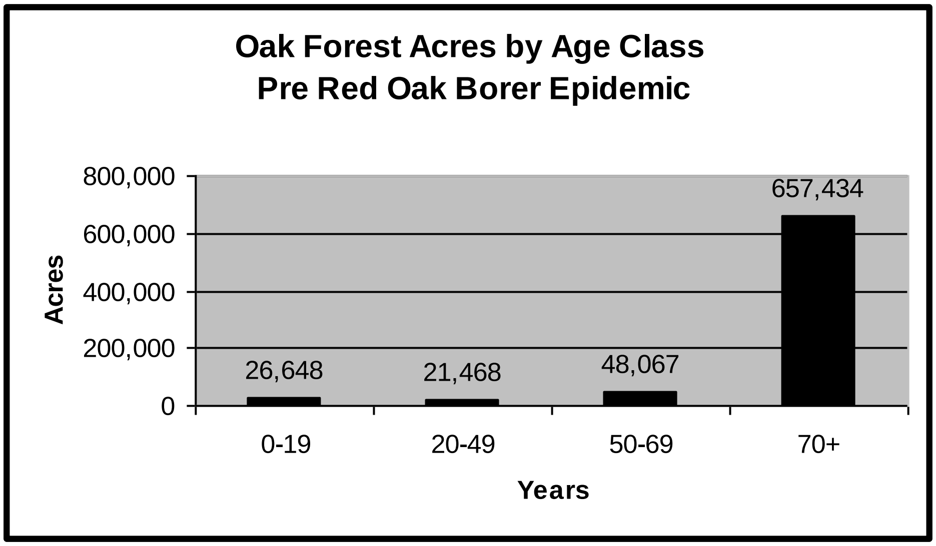

Figure 3-16: Oak Forest Acres by Age Class.

Beginning in 1999 after extreme drought conditions, an oak decline related red oak borer epidemic began. The red oak borer and white oak borer are native borer species, which are typically found at healthy population levels within natural oak ecosystems. At healthy population levels, these borers rarely kill the tree they inhabit. However, the availability of highly vulnerable oak stands in conjunction with record drought levels and excessive stand densities lead to a borer epidemic. To date, it has affected an estimated 340,000 acres on the Ozark NF, primarily in the red oak/white oak/hickory forest types. 40,000 acres of the affected area are categorized as high (> 50%) oak mortality. In addition to the significant loss of oak species from this epidemic, it should be noted that within the affected area an estimated 90 percent of mortality was in the red oak family.

The highly affected areas are so heavily damaged that they no longer represent their pre-epidemic conditions. These areas have lost the majority of their overstory oak component, opening the forest floor to light, and leaving primarily shade-tolerant species, which thrive in open conditions and can quickly outgrow any remaining oak regeneration. Based on office calculations, the age-class distribution for the hardwood acres has been slightly redistributed (Figure 3-17). Some of the approximately 40,000 acres are now considered "younger". These areas have lost their overstory component and are expected to shift, without intense management, from highly desirable oak forests to maple/dogwood forests. The remaining 28,000 acres have lost their mid-story structure component and, as a result, are considered to be "older" based on the minimal overstory remaining. This transition is significant due to the loss of wildlife benefits and valuable timber resources. Since 2000, a loss of a half a billion board feet is estimated across the Ozark NF due to the red oak borer epidemic.

Two summers of average precipitation levels, and subsequent increases in sap flow have shown a decline in oak borer population levels. However, the majority of the

hardwood acres on the Forests remain vulnerable with high stand density levels and older, more susceptible trees. Under the right conditions, another epidemic is a legitimate threat.

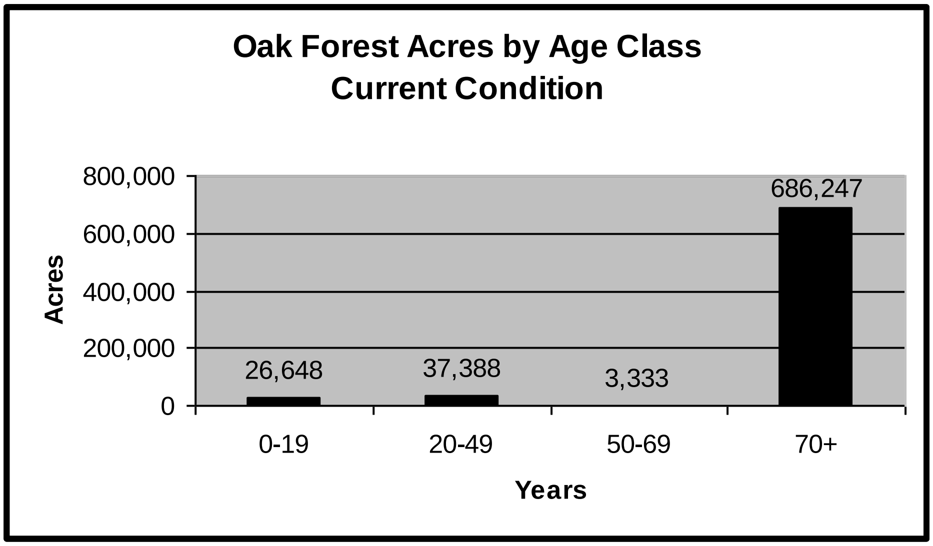

Figure 3-17: Age-Class Distribution for Hardwood Acres.

Direct and Indirect Effects

Oak decline is currently the most threatening native disease for the OSFNFs with over 700,000 acres being considered highly vulnerable to the disease. As stated previously, oak decline risk factors include excessive stand densities, stand age, and long-term predisposing stresses (e.g., drought). Land managers have no control over environmental stress factors and have little control over the number of insects invading oak decline trees. Attempts to suppress insect pests over the entire (or significant part of the) landscape cannot be justified economically, socially, or environmentally. Thus, stand age and densities are the factors that land 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. Therefore, the best tool in combating oak decline is vegetation manipulation through various types of timber harvesting.

Oak decline is so pervasive in northern Arkansas, and the eastern United States, that no reasonable alternative can adequately address the risk at the landscape scale. Due to Agency budgetary constraints, it is unrealistic that any alternative will represent a major shift from the current highly vulnerable condition of the Forests. However, some alternatives address the risk better than others do. Table 3-124 displays the acres by alternative for Decade 1 and Decade 5 of hardwood acres thinned and regenerated. Table 3-125 displays the age class distribution of hardwood acres by alternative for Decade 1 and Decade 5. These estimates of harvest management acres are based on the results of the SPECTRUM analysis (see Appendix B for more information).

Table 3-124: Acres Thinned/Regenerated for Hardwoods by Alternative in Decades 1 & 5.

Hardwood*	Alternative				
	A	B	C	D	E
Regeneration	**Acres**				
Decade 1	90,333	62,700	45,809	95,837	60,000
Decade 5	35,328	20,667	53,639	32,513	48,567
Thinned	**Acres**				
Decade 1	482	5,110	2,761	8,429	5,150
Decade 5	0	3,559	9,294	5,193	9,764

***Data gathered from SPECTRUM Model.**

Table 3-125: Age Class Distribution for Hardwoods by Alternative in Decades 1 & 5.

Age Class Hardwood*	Alternative				
	A	B	C	D	E
Decade 1	**Acres**				
0-10 years	90,333	62,700	45,809	95,837	60,000
11-41 years	41,047	38,072	40,719	40,122	39,348
41-100 years	116,668	108,806	109,484	117,548	118,613
101+ years	522,684	511,250	566,913	507,296	552,302
Decade 5	**Acres**				
0-10 years	35,328	20,667	53,639	32,513	48,567
11-41 years	54,992	43,010	70,611	54,985	41,549
41-100 years	155,039	115,683	110,157	159,621	132,746
101+ years	525,373	541,467	528,518	513,684	547,401

***Data gathered from SPECTRUM Model.**

Based only on these three qualifiers, Alternative D will be the most effective alternative to reduce the risk of oak decline in the first decade. Alternative D has the highest levels of estimated hardwood regeneration and thinning acres and the least amount of acres in the 101+ years age class. Alternatives A, C, and E will have a moderate impact. Alternative B, which has a concentrated management emphasis, is expected to have the least effect of all the alternatives at a forest-wide level. Projections for the fifth decade are generally the same as the first. Alternative D will have the least number of acres in the 101+ age class, but Alternative C will have the highest number of acres projected for harvest. Because Alternative D has a balance age class emphasis, it is expected to be the most effective of all the alternatives at reducing the risk of oak decline.

Cumulative Effects

Oak decline will continue to be a major threat to the Ozark Highlands, especially on National Forest System lands, because of the higher incidence of older, oak-dominated stands. In heavily affected oak decline areas (in the absence of restoration/reforestation treatments, including prescribe fire) other species already present in competitive positions in the understory are expected to replace much of the oak component. Oak will most likely be replaced by maple and gum species. The loss of oak will have effects on ecosystem structure and function. Structure becomes

more complex as canopy density is reduced and the number of small opening increase. The number of snags and down wood will also increase. Overall, susceptibility to decline will be reduced due to fewer and smaller, more vigorous, oaks. Hard-mast production will continue to be reduced in quantity, quality, and diversity as oak decline incidence increases across the Forests.

NON-NATIVE INSECTS

European Gypsy Moth

Affected Environment

European gypsy moth (*Lymantria dispar*) was introduced into the United States in 1869. A defoliator, it has caused considerable damage to forests in the northeastern part of the country and has gradually expanded its range. Because the favored host, oak, is widespread in the eastern deciduous forests, the gypsy moth thrives and continues to expand its range west and south each year. Scientists expect the moth's natural expansion to reach the Ozark-Ouachita Highlands between 2025-2050 (OOHA, Rpt 5 1999). Positive identifications of gypsy moth have been found in northern Arkansas.

European gypsy moths feed on numerous trees, shrubs, and vines but prefer oaks. After European gypsy moth larvae hatch in the spring, the young caterpillars climb to the tops and extended branches of trees. From there they ride the winds for distances of up to two miles. The airborne caterpillars land on other host plants and begin intense feeding. Locally, this occurs in late April or early May. The caterpillars feed through May and early June, going through five or six larval stages as they increase in size and appetite. They then reach the pupal stage where they transform into moths. Male moths emerge first and begin their search for females. The females do not fly, but stay very close to where they pupate, emitting a pheromone to attract male moths. After mating, the female lays an egg mass that contains approximately 300 to 750 eggs, and then dies. The next generation overwinters within the egg mass, and repeats the cycle in the spring (OOHA, Rpt 5. 1999).

Spread rates for the European gypsy moth have increased from 1.8 miles/year from 1916-1965 to more than 12.4 miles/year from 1966-1990 (OOHA, Rpt 5 1999). In addition to the steady spread of the adults by wind, they can be transported in other life stages by human activities. Movements aided by humans cause isolated infestations outside core infestation areas (OOHA, Rpt 5. 1999). Where European gypsy moths are numerous, the larvae can defoliate trees. Their impact on a forest stand depends upon the abundance of host trees and other site and stand conditions. Defoliated trees may die, either directly as the result of repeated defoliation or indirectly from drought, disease, or other pests. Vigorous trees can withstand one or two consecutive defoliations, but trees in poor conditions can die after a single defoliation. If left untreated, a European gypsy moth infestation causes a shift in the overstory from primary host species, such as oak, to other species. As susceptible trees die, other organisms are affected, such as plants dependent on the overstory for shade and animals dependent on the plants (OOHA, Rpt 5 1999).

The European gypsy moth was first discovered in Arkansas near Hardy in 1982. The infestation was eradicated in 1983. A separate infestation in Boone, Carroll, Madison, Marion, and Newton Counties has been the subject of a 5-year eradication project (OOHA, Rpt 5 1999). Management of the European gypsy moth on the OSFNFs consists mainly of monitoring through trapping and eradication projects where necessary. Accidental introductions during the transport of lumber, firewood, or nursery stock will likely cause small spot infestations (OOHA, Rpt 5 1999).

Direct and Indirect Effects

As the area of infestation as well as the natural range of the European gypsy moth expands, the frequency of accidental introductions of gypsy moth on the OSFNFs will increase. Activities that increase travel between the infested area and the Forests, such as tourism and commerce, can be expected to increase the number of accidental introductions of gypsy moth onto the national forests. Accidental introductions of gypsy moth may lead to the use of insecticides to locally eradicate the moth and prevent it from becoming established on the Forests. Used this way, eradication is a delaying tactic; part of an overall "slow the spread" (STS) strategy keeping accidental introductions of gypsy moth from becoming established on the Forests ahead of natural expansion of their range. Over time, however, the OSFNFs are expected to become infested by gypsy moth, and will be subjected to occasional outbreaks of this insect as populations increase regionally. Defoliation may be extensive and severe when gypsy moth outbreaks do occur. As with many other insects and diseases mentioned in this section, the European gypsy moth's favored host is dense (overstocked), older oak and oak/pine forest types, of which the OSFNFs currently have over 700,000 acres.

The logical conclusion is that those alternatives that harvest more acres in oak and oak/pine stands will have a more positive impact on reducing gypsy moth risk. Table 3-112 shows the hardwood acres either regenerated or thinned by alternative in the first and fifth decades and Table 3-113 displays the age class distribution in hardwood stands by alternative for Decade 1 and 5. As mentioned previously in this section, because of the extent of the vulnerability and the economic and social limitation of high levels of harvesting, no reasonable alternative will adequately reduce the risk of gypsy moth. Based on the three qualifiers found in the tables mentioned above, Alternative D will be the most effective of the alternatives to reduce the risk of European gypsy moth in the first decade. Alternative D has the highest levels of estimated hardwood regeneration and thinning acres and the least amount of acres in the 101+ years age class. Alternatives A, C, and E will have a moderate impact. Alternative B, which has a concentrated management emphasis, is expected to have the least effect of all the alternatives at a forest-wide level. Projections for the fifth decade are generally the same as the first. Alternative D will have the least number of acres in the 101+ age class, but Alternative C will have the highest number of acres projected for harvest. Because Alternative D has a balance age class emphasis, it is expected to be the most effective alternative at reducing the risk of European gypsy moth.

While suppression and or eradication of gypsy moth populations would be permissible under all alternatives, 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 Forests receiving such management actions. Generally, gypsy moth outbreaks on most national forest lands will not be managed actively and population outbreaks will be brought to an end through the action of natural control agents. However, where high value resources, such as developed recreation areas, are threatened with defoliation and damage, treatment with insecticides may be considered to mange gypsy moth populations and limit damage. The impacts associated with such 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, and impacts on human health.

NATIVE INSECTS

Southern Pine Beetle

Affected Environment

The southern pine beetle (SPB) is one of the most destructive pests of pines in the southern United States, Mexico, and Central America. The SPB is native to this area. It attacks and can kill all species of pines but prefers loblolly, shortleaf, Virginia, pond, and pitch pines. Drought, overstocked stands, absence of natural enemies, and stand disturbances are among the conditions that appear to be contributing factors in outbreaks, which are cyclic (OOHA, Rpt 5. 1999).
Discoloration of the crowns of trees usually indicates an outbreak of SPB. Discoloration progresses rather rapidly over the whole crown, with the fading needles soon turning to a reddish brown. Pitch tubes, small yellowish-white masses of pitch on the trucks of affected trees, are the points of beetle attack. In unusually dry weather, however, there may be no pitch or only mere traces of it under bark scales where the beetle bored into the tree. In this situation, the only evidence of attack may be reddish-brown boring dust lodged in bark crevices and in cobwebs on the truck or at the base of the tree (OOHA, Rpt 5. 1999).

Removal of a piece of bark from an infested pine will reveal an array of winding galleries on the inner bark and on the wood surface, a characteristic that clearly distinguishes the presence of the SPB from any other pine bark beetle in the South. If the attack is recent, there may be some adults in the egg galleries or very tiny, whitish larvae near the galleries. In older attacks, most of the brood will be within the bark (OOHA, Rpt 5. 1999). The adult SPB carries numerous spores of a bluestain fungus. When an adult beetle attacks a tree, the bluestain spores are carried into egg galleries where the spores germinate. Bluestain fungus colonies grow into the wood of infested pines, stopping the upward flow of water to the tree crown. Lack of water causes needles to wilt and die within two to eight weeks, depending on temperatures (OOHA, Rpt 5 1999).

The SPB may overwinter in infested pines as adults, immature adults, pupae, or larvae. Beetles of overwintering broods begin to emerge and attack trees in April or May. The life cycle from egg to adult requires 27 to 40+ days, depending upon the weather. Four to six generations are produced per year (with considerable overlapping). Beetle populations and beetle activity generally reach a peak in mid-summer. The number of beetles may increase as much as tenfold in a single season. Activity slows as temperatures decrease. However, beetle flights and attacks also occur in winter during prolonged warm spells, even at higher elevations in the mountains (OOHA, Rpt 5. 1999).

Successful SPB attacks are dependent on two factors: the ability to mass attack pine trees and the ability to have overlapping (multiple) generations produced at the same time in an infested stand of pine trees. SPB usually attacks the mid-truck of a tree first, and then moves upward and downward. While larger trees are more commonly attacked, trees as small as two inches in diameter also may be infested. Natural enemies (including insect parasites, predators, diseases, and woodpeckers) rarely have a notable effect on the SPB during severe outbreaks (OOHA, Rpt 5. 1999).

The first outbreak of SPB in Arkansas was reported in 1974. Many counties in northern Arkansas have never had an outbreak, despite the occurrence of shortleaf and loblolly pine. It is unclear why the SPB populations on the OSFNFs have remained at healthy levels. There does not appear to be any environmental factors that would limit an infestation. Active harvesting in pine-dominated stands on the southern portion of the Ozark NF reduces the risk of SPB spread from southern Arkansas.

Black Turpentine Beetle

Affected Environment

Like the southern pine beetle, black turpentine beetles (*Dendroctonus terebrans*) have caused extensive damage throughout the pine belt in the South. However, black turpentine beetles are less of a threat on the OSFNFs. Drought, flooding, and severe stand disturbances caused by mechanized logging, fire, or other insects, such as the southern pine beetle and Ips beetle, appear to be contributing factors. The insect prefers freshly cut stumps for breeding. The beetle also prefers weakened trees, such as those damaged by fire, worked for sap collection, or ingested by other bark beetles. The black turpentine beetle seldom persists at a high population level for longer than one to two years. When the beetle's population is increasing dramatically, it is capable of attacking healthy trees. The beetle tends to work slowly and persistently throughout the year. Rarely do black turpentine beetle populations increase at rates high enough to be considered an outbreak. Attacks of black turpentine beetle are usually not fatal. In trees that are killed, the needles begin to lose their normal healthy green color and fade (OOHA, Rpt 5. 1999).

Black turpentine beetles are found throughout the shortleaf and loblolly pine stands on the OSFNFs. Although the beetle does cause damage to residual stands its population levels remain in check and does not appear to be a major threat to forest health at this time.

Ips Bark Beetles

Affected Environment

The name Ips beetle refers to a genus of pine bark beetles. There are three principal species of Ips bark beetles attacking pines on the OSFNFs: the eastern six-spined and five-spined engraver and the small southern pine engraver. The only insect to kill more pine trees in the South than this group of beetles is the southern pine beetle, which often attacks trees in combination with one or more of the three Ips species and/or the black turpentine beetle. It is common to find one or more species of Ips, as well as other pine-infesting beetles inhabiting various parts of the same tree. At least 16 species of pine in the United States, including loblolly and shortleaf pine, are hosts to one or more of the Ips species. Ips beetles usually attack weakened, dying, or recently felled trees and fresh logging debris. Large numbers of Ips may build up when natural disturbances such as lighting storms, ice storms, tornadoes, wildfires, and droughts create conditions suitable for breeding. Ips populations may also increase following forestry activities, such as prescribed burns that get too hot and kill or weaken pines; and cutting operations that compact soils, wound trees, and leave large amounts of branches, cull logs, and stumps for breeding sites (OOHA, Rpt 5. 1999). Like the black turpentine beetle, Ips is found on the OSFNFs where they can cause damage to residual stands. However, their population levels remain healthy at this time.

Direct and Indirect Effects

The current populations of the black turpentine beetle and Ips bark beetles are not expected to change drastically, either positively or negatively, by alternative. These species are currently found throughout the pine stands of the OSFNFs. In general, these species favor weaken trees and/or stands that have received severe disturbances, either human or natural caused. Generally speaking, the pine stands on the Forests have been actively managed in the past. This level of management is not expected to change in Alternatives A, C, and E, so the threat and population of these beetles is not expected to increase or decrease. Alternative D has a balanced age class emphasis and because the pine stands on the Forests have a more balanced age class than the hardwood stands, the management emphasis will fall to the hardwood stands on the Forests. Alternative C emphasizes ecosystem restoration and is expected to initially concentrate regeneration harvesting efforts in hardwood stands on the Forests. Because of this, at least initially, the human-caused disturbances in the pine stands will be reduced, theoretically reducing the potential for black turpentine and Ips bark beetles.

Although SPB also favors areas with stand disturbances, the most prevalent host type conditions are overstocked stands, environmental stressors (drought), and stand age. Managing stand densities by thinning, prescribed burning, and regenerating stands can greatly reduce SPB hazards and subsequent tree losses.

The Ozark NF is one-third (318,372 acres) pine-dominated stands. Of these 318,372 acres, roughly one-third (114,377 acres) is known to be greater than 70 years old and, theoretically, susceptible to SPB outbreaks. SPBs are found widely throughout the Southeast and in central Arkansas, but have not been found at epidemic levels on the Forest. It is unclear why the Forests' SPB populations have not reached epidemic portions, as there does not appear to be any environmental factors limiting heavy infestations. Despite the lack of a current problem, the Forests are still considered susceptible to outbreaks. Depending on future environmental stressors, the Forests may or may not be faced with a SPB epidemic.

Table 3-126 displays the acres thinned or regenerated in pine stands by alternative for the first and fifth decades. These acres are considered estimates based on management objectives and are a product of the SPECTRUM model (see Appendix B for more details).

Table 3-126: Acres Thinned/Regenerated in Pine Stands by Alternative in Decades 1 & 5.

Pine*	Alternative				
	A	B	C	D	E
Regeneration	**Acres**				
Decade 1	2,145	0	7,143	4,163	0
Decade 5	10,255	20,842	1,494	25,519	2,799
Thinned	**Acres**				
Decade 1	42,040	42,348	79,286	26,571	59,850
Decade 5	38,762	25,870	51,330	29,807	50,236

***Data gathered from SPECTRUM Model.**

Table 3-127 displays the anticipated age class distribution in the pine stands in the first and fifth decades by alternative. Based on these qualifiers, in the first decade, it can be concluded that alternative A would reduce the SPB risk the most as it is projected to harvest a high number of acres and it maintains a low number of acres in the oldest (101+) age-class. Alternatives C, D, & E are also projected to show a moderate SPB reduction. Alternative B, with its concentrated management emphasis, will be the least effective at reducing the SPB risk on the Forests.

Table 3-127: Age Class Distribution for Pine Stands by Alternative in Decades 1 & 5.

Age Class Pine*	Alternative				
	A	B	C	D	E
Decade 1	**Acres**				
0-10 years	2,145	0	7,143	4,163	0
11-41 years	89,281	70,499	87,515	87,426	81,185
41-100 years	206,140	233,632	209,710	215,160	225,356
101+ years	18,211	51,094	18,870	19,052	18,820

***Data gathered from SPECTRUM Model.**

Table 3-127: Age Class Distribution for Pine Stands by Alternative in Decades 1 & 5. (Continued)

Age Class Pine*	Alternatives				
	A	B	C	D	E
Decade 5	**Acres**				
0-10 years	10,255	20,842	1,494	25,519	2,799
11-41 years	73,840	64,388	57,111	86,983	58,451
41-100 years	153,540	120,396	156,608	140,642	153,124
101+ years	78,142	149,599	108,025	72,656	110,987

***Data gathered from SPECTRUM Model.**

Cumulative Effects

When considering actions of private and other agency lands within or directly adjacent to the Ozark NF, cumulative impacts regarding SPB hazard is somewhat mixed. Lands administered by federal and state agencies are unlikely to receive a great deal of vegetation manipulation. Thus, SPB events can be expected to increase dramatically on these acres, for all of the previously mentioned reasons. Conversely, management actions on privately held lands vary quite a bit depending upon the objectives and beliefs of individual landowners. Certainly those forested acres held by private industry are likely to be intensively managed and SPB outbreaks aggressively fought. However, many acres of privately held land would remain unmanaged and likely increase the hazard of SPB outbreaks.

OTHER THREATS

Storm Damage

Affected Environment

Storm damage to trees is similar whether from tornadoes, hurricanes, straight-line winds, microburst, or snow or ice loading with or without wind. Two or more of these events occurring together result in greater damage. Storm stresses cause both hardwoods and pines to break off, split, be "root sprung", bend, and suffer branch and foliage losses.

Damaging storms produce other challenges in their wake. Roads and streams are clogged with debris. Visitor-use areas may become unsafe and/or unsightly. Buildings may be damaged or destroyed. The amount of fuel available to future fires is greatly increased. Damaged trees are often a breeding ground for subsequent insect or disease problems. However, they are also a natural ecosystem dynamic that can result in forest community regeneration and diversity of both terrestrial and aquatic wildlife habitat. Storm damage of some magnitude occurs regularly on the OSFNFs.

Direct and Indirect Effects

Generally, older forests will be more susceptible, and likely to suffer damage, from storms because of larger crowns, larger limbs, and higher incidence of root and stem

diseases. In the first decade in all alternatives, stands over 100 years of age make up an average of 80 percent of the forested acres on the OSFNFs. Theoretically, the majority of the Forests are highly susceptible to storm damage. Pine stands are highly susceptible to ice damage because of their evergreen character. In the event of an ice storm, increased damage may be found in pine stands. Storm damage may result in additional stresses to individual trees increasing susceptibility to insects and diseases and, in some cases, establishing a foothold for outbreaks or epidemic conditions. Younger trees (past the sapling stage) are generally damaged less severely and in many cases survive, grow, and mature after storm events. Therefore, alternatives with harvesting that provides for younger stands will result in less overall storm damage. Although land managers have no control other weather conditions and storm events, they do have some control over the levels of land management within the OSFNFs. Table 3-128 displays the estimated acres regenerated in the first and fifth decades by alternative. Based only on this qualifier, Alternative D will be the most effective at reducing the risk of storm damage on the Forests.

Table 3-128: Estimated Acres Regenerated by Alternative by Decade.

Acres Regenerated	Alternative				
	A	B	C	D	E
	Acres				
Decade 1	92,479	62,700	52,953	100,000	60,000
Decade 5	45,583	41,509	55,133	58,032	51,366

Table 3-129 displays the estimated prescribed burning acres by alternative. Fire as a tool in conjunction with other silviculture practices is expected to play a role in the increase of over-all forest health. Increased forest health will increase a forest stands' ability to fight off insects and disease and decrease the level of detrimental storm damage.

Table 3-129: Estimated Prescribed Burn Acres by Alternative in Decade 1.

Prescribed Burn Acres	Alternative				
	A	B	C	D	E
	Acres				
Decade 1	70,000	80,000	150,000	90,000	120,000

Cumulative Effects

Damage resulting from storms (ice, snow, tornadoes, and wind) will inevitably affect all ownership classes. However, federally managed lands generally have large acreages in older forest conditions while private forest industry does not. Therefore, the risk to public lands is greater. Additional stresses resulting from storm damage would potentially be more likely on public land than in other ownership categories.

RESOURCE MANAGEMENT PROGRAMS

RECREATION/DEVELOPED AND DISPERSED

Affected Environment

National forests (NFs) provide over 191 million acres of public land within the United States. NFs in the Ozark Highlands contribute approximately 4 million acres, about 10 percent of the assessment area (OOHA, Rpt 1, Pg 3 1999). These NF lands provide unique settings for a variety of outdoor recreation activities such as primitive and developed camping, hunting, fishing, hiking, backpacking, horseback riding, OHV driving, canoeing/kayaking, and whitewater rafting as well as picnicking, sightseeing, nature watching, and walking 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. (This definition will be used for this analysis). Past research has demonstrated that most national forest visits originate from within a 75-mile (1½ hour driving time) radius. (*Ouachita and Ozark National Forest Recreation Realignment Report,* Overdevest and Cordell 2001).

The market area for the OSFNFs includes the market areas defined for the Ouachita National Forest. These market areas were combined in recognition of shared local markets, similar geography, and demographic patterns. The largest cities within this shared market area for the Ozark NF include

- Tulsa, Oklahoma
- Springfield, Missouri
- Ft. Smith and Little Rock, Arkansas

The market area for the St. Francis NF was combined with portions of the National Forests of Mississippi. Some of the major cities in that market area include

- Memphis, Tennessee
- Greenville and Jackson, Mississippi

Opportunities for outdoor recreation are not limited to the national forests within the market areas. As Figure 3-18 demonstrates, the national forests in Arkansas provide approximately 63 percent of public land used for recreation. Other federal, local, and state agencies make up the difference.

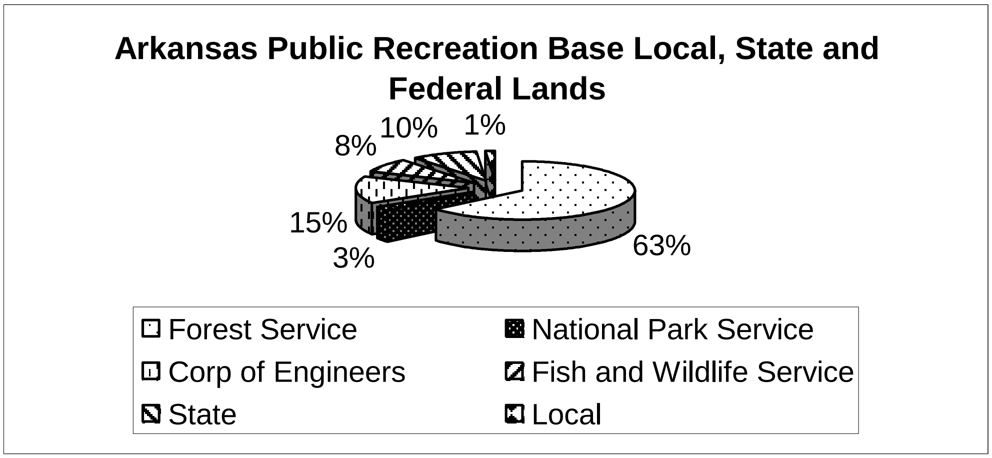

Figure 3-18: Breakdown of Public Land Used for Recreation. Data Source: Arkansas SCORP, 1995.

The location of the OSFNFs in Arkansas makes them readily accessible to people in most of Arkansas, as well as several surrounding states such as Mississippi, Missouri, Oklahoma, Tennessee, and Texas. Major transportation arteries provide easy access to these Forests, and they are valued by growing urban populations seeking economical "escapes" to undeveloped landscapes.

The Ozark NF provides approximately 1.2 million acres of public land, and the St. Francis NF provides approximately 23,000 acres of public land in Arkansas. Each Forest provides experiences specifically related to distinctive natural features. The more mountainous Ozark NF provides opportunities for high quality nature-related sightseeing and scenic viewing. Other features on the OSFNFs include six different Wild and Scenic Rivers; five congressionally designated wilderness areas, the Ozark Highlands Trail, and remote hunting experiences. The St. Francis NF provides opportunities to view a forest that more resembles Appalachian forests. The Crowley's Ridge area has many unique tree species not found on the Ozark NF. The bottomlands of the St. Francis NF offer an opportunity to see the Mississippi River.

Recreation Demand & Trends

Recreation demand and trend is a complex relationship/mix of people's desires and preferences, availability of time, price, availability of facilities, demographics, and economic profiles. The evaluation of current and future recreation demand and trend for the OSFNFs is based on recent surveys that identify and quantify. The following are some of the components to these surveys:

- Estimated number of current recreation visits to the OSFNFs.
- Participation rates for recreation activities within the forest market area.
- Future activity demand based on projected trends from research.
- 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 OSFNFs.

Table 3-130 shows the visits to OSFNFs by site type. 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 that drive through the National Forests.

Table 3-130: Baseline for Recreation Use on OSFNFs.

Type of Recreation Sites	Current Percentage of Total Estimated Recreation Visits*
Day-Use (Developed)	37%
Overnight-Use (Developed)	5%
Wilderness (Dispersed)	1%
General Forest Areas (Dispersed)	57%
Total	100% (2,700,794 estimated visits)

***Refer to Appendix B, NVUM report and visits by site type, Don English.**

Based on this NVUM data, "developed recreation" areas (recreation taking place in areas with developed facilities such as restrooms, pavilions, tables, and campsites) on the OSFNFs accommodate approximately 42 percent of the estimated recreation visits. The remaining 58 percent of recreation visits can be defined as "dispersed recreation" that occur away from developed sites in general forest areas and designated wilderness.

People within the defined market area for the OSFNFs engage in a variety of recreation activities. Table 3-131 lists the types of activities that can be enjoyed on the Forests. They have been ranked in order from highest to lowest predicted trends through 2050 based on the National Survey on Recreation and the Environment (NRSE), an on-going national telephone survey sponsored by the USFS. Table 3-89 also displays the number of people (in millions) over 16 years old participating in recreation activities in Ouachita and Ozark NF market area and percentage increase over next 50 years (*Ouachita and Ozark National Forest Recreation Realignment Report*, Overdevest and Cordell 2001 and from *Outdoor Recreation in American Life, A National Assessment of Demand and Supply Trends*, H. Ken Cordell, Principal Investigator 1999)

Table 3-131: Types of Activities Available, Number of People (in millions) Over 16 Years Old Participating in Recreation Activities in Ouachita and Ozark NFs Market Area, and Percentage Increase Over Next 50 Years.

Recreation Activity	2001 Participation Rate	2000 # of People	2010 Increase	2020 Increase	2030 Increase	2040 Increase	2050 Increase
Developed Camping	27%	1.93	27% 2.45	60% 3.09	98% 3.82	144% 4.71	201% 5.81
Visit wilderness or primitive area	32%	2.9	25% 3.63	57% 4.55	96% 5.68	108% 6.03	171% 7.86
Backpacking	8%	0.99	23% 1.22	57% 1.55	96% 1.94	108% 2.06	171% 2.68
Visit historic site	35%	4.55	22% 5.55	47% 6.69	77% 8.05	113% 9.69	155% 11.60
Day hiking	27%	2.62	19% 3.12	38% 3.62	59% 4.17	78% 4.66	94% 5.08
View/photo-graph nature or scenery	54%	5.44	15% 6.26	31% 7.13	48% 8.05	66% 9.03	86% 10.12
Driving for pleasure	52%	4.95	15% 5.7	31% 6.48	48% 7.33	66% 8.22	86% 9.21
View wildlife	46%	4.11	15% 4.73	31% 5.38	48% 6.08	66% 6.82	86% 7.64
View natural vegetation, trees	43%	4.05	15% 4.66	31% 5.31	48% 5.99	66% 6.72	86% 7.53
View birds	33%	2.92	15% 3.36	31% 3.83	48% 4.32	66% 4.85	86% 5.43
View/photo-graph fish	28%	2.43	15% 2.79	31% 3.18	48% 3.60	66% 4.03	86% 4.52
Mountain biking	12%	1.64	12% 1.84	26% 2.07	42% 2.33	61% 2.64	83% 3.00
Picnicking	51%	4.8	11% 5.33	23% 5.90	37% 6.58	53% 7.34	71% 8.21
Warm water fishing	38%	2.62	9% 2.86	17% 3.07	24% 3.25	26% 3.30	26% 3.30
Coldwater fishing	16%	1.28	9% 1.40	17% 1.50	24% 1.59	26% 1.61	26% 1.61
Horseback riding - trails	12%	0.76	9% .83	19% .90	27% .97	30% .99	31% 1.00

Table 3-131: Types of Activities Available, Number of People (in millions) Over 16 Years Old Participating in Recreation Activities in Ouachita and Ozark NFs Market Area, and Percentage Increase Over Next 50 Years. (Continued)

Recreation Activity	2001 Participation Rate	2000 # of People	2010 Increase	2020 Increase	2030 Increase	2040 Increase	2050 Increase
Swimming in streams, lakes	39%	4.17	6% 4.42	13% 4.71	20% 5.00	29% 5.38	41% 5.88
Drive off-road	22%	1.76	5% 1.85	10% 1.94	16% 2.04	23% 2.16	34% 2.36
Canoeing	13%	0.73	5% .77	9% .80	16% .85	30% .95	31% .96
Rafting	10%	1.06	5% 1.11	9% 1.16	16% 1.23	30% 1.38	51% 1.60
Kayaking	2%	0.23	5% .24	9% .25	16% .27	30% .30	31% .30
Motor Boating	31%	2.6	1% 2.26	3% 2.68	6% 2.76	11% 2.89	17% 3.04
Primitive Camping	19%	1.44	-2% 1.41	0% 1.44	0% 1.44	5% 1.51	0% 1.44
Big Game Hunting	14%	0.89	-3% 1.75	-7% 1.72	-11% 1.68	-17% 1.63	-24% 1.57
Small Game Hunting	13%	0.82	-3% 1.62	-7% 1.58	-11% 1.55	-17% 1.50	-24% 1.44
Migratory Bird Hunting	5%	0.17	-3% .33	-7% .33	-11% .32	-17% .31	-24% .30

***Data increases show change from 2001, columns shaded gray are the estimated life of the plan.**

Another way to look at projected recreation use on the OSFNFs is displayed in Table 3-132. This table shows the expected increase every five years. This is more helpful in projecting recreation demand in a shorter time frame.

Table 3-132: Total and Average Increase Every 5 Years.

Recreation Activity	Total Increase 2000-2050	Real Average 5 Year Increases
Developed Camping	201.0%	11.6%
Resorts, Cabins	201.0%	11.6%
Backpacking, Camp in Unroaded Areas	171.0%	10.5%
Wilderness	171.0%	10.5%
Visiting Historical Sites	155.0%	9.8%
Visiting Nature Centers	155.0%	9.8%
Viewing Wildlife, Birds, Fish	102.0%	7.3%
Nature Study	102.0%	7.3%
Hiking/Walking	94.0%	6.9%
Viewing Scenery	86.0%	6.4%
Driving For Pleasure	86.0%	6.4%
Bicycling	83.0%	6.2%

Table 3-132: Total and Average Increase Every 5 Years. (Continued)

Recreation Activity	Total Increase 2000-2050	Real Average 5 Year Increases
Picnicking	71.0%	5.5%
Gathering Berries, Natural Products	71.0%	5.5%
General Relaxing	65.0%	5.1%
Swimming	41.0%	3.5%
Off-Highway Vehicles (OHVs)	34.0%	3.0%
Horseback Riding	31.0%	2.7%
Fishing	26.0%	2.3%
Canoeing, Kayaking, Rafting	21.0%	1.9%
Motorized Water Travel	17.0%	1.6%
Primitive Camping	-8.0%	-0.8%
Hunting	-24.0%	-2.7%

Demographic information collected within the market area also revealed trends affecting recreation demand. As a large segment of the American population ages, demand is growing for less physically challenging activities such as viewing wildlife and driving for pleasure. The desire for easier access to facilities and forest settings is increasing as the physical abilities of the aging population decreases. However, there is still significant demand for physically challenging outdoor experiences such as whitewater rafting/canoeing/kayaking; rock climbing and rappelling; hang gliding; hiking; horseback riding; and backpacking.

Household sizes of one person, two persons, and four persons are becoming more typical. Smaller families, couples, and individuals seem to enjoy dispersed recreation activities such as fishing, backpacking, and visiting wilderness or other primitive areas. Ethnic populations are also expected to drastically change in the Nation. Hispanic use of developed recreation sites hardly existed 10 to 15 years ago. Currently, Cove Lake, Long Pool, and other campgrounds are experiencing a dramatic increase in use by Hispanics.

Figure 3-19 shows the projections for population change in the Nation from 2000-2050. These changes were retrieved from the *Recreation Realignment Report* and show the following population changes:

- Anglo Americans 76% 50%
- African Americans 12% 15%
- Hispanic Americans 9% 21%
- Asian/Other 4% 11%

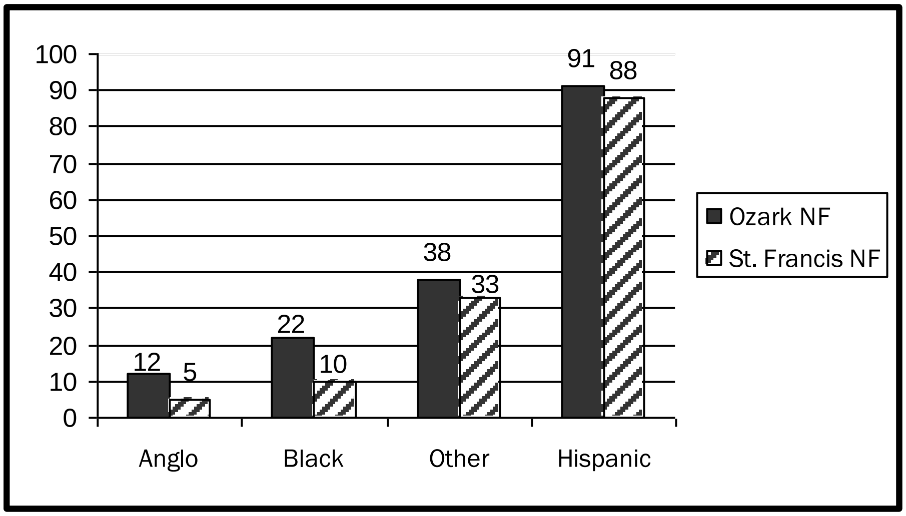

Figure 3-19: Projected changes in population from 2000-2050. Source: Chart B, Expected Percentage change in population ethnicity on the OSFNFs, 2000-2020 (Recreation Realignment Report)

It is estimated that by the year 2050, demand for facilities that accommodate family reunions and social gatherings may increase as people seek opportunities to connect with larger groups in natural settings. As population in the market area continues to grow and more areas are developed, public lands such as the OSFNFs will increasingly be seen as places of relaxation, quiet retreats from the populated community. As forest recreation demands grow, some recreation activities are more likely to conflict with others especially on trails; in backcountry; at developed sites; on lakes, streams, whitewater; and on roads and their nearby environs (Cordell 2001). Table 3-133 shows some of the fastest and slowest growing counties surrounding the OSFNFs.

Table 3-133: Fastest and Slowest Growing Counties in the Market Area, 1990- 2000

Fastest Growing	Percent Change 1990-2000	Slowest Growing	Percent Change 1990-2000
Benton	57.3	Phillips	-8.6
Washington	39.1	Lee	-3.6
Marion	34.5	Searcy	5.4
Crawford	25.3	Conway	6.2
Johnson	25.0	Logan	9.4

Source: U.S. Census, NRIS HD Model

According to the various charts and tables, the OSFNFs have some unique challenges in trying to match opportunities with projected need. Ozark-Ouachita Highlands Assessment (OOHA) pointed out the national forests provide about 6% of the developed recreation campsites, and about 63 percent of the dispersed recreation opportunities. The Corps of Engineers and the Arkansas State Parks provide the majority of the developed sites. Many counties surrounding the Ozark NF are expecting a 15 to 73 percent increase in growth over the next 20 years. Stone and Newton Counties on the Ozark NF as well as Lee and Phillips Counties on the St. Francis NF are expecting negative growth.

The Ozark NF receives a lot of uncontrolled OHV use. There are many roads on the OSFNFs; some are classified as Level 1 roads, which technically are supposed to be closed. These roads were either temporary roads, or built years ago to accommodate timber harvests. Some of these roads are in poor locations, not usable by passenger cars. OHVs readily use these roads even though according to the OSFNFs' OHV policy, they are closed. There are four designated OHV areas on the Ozark NF. There is strong demand for additional OHV trail areas, and the ability for users to ride cross-country. Comments received throughout the revision process were heavily weighted toward increasing designated OHV areas, and maintaining a system of roads and trails that OHV users can use. In 2001, Arkansas ranked 13th in the United States in OHV sales. The demand for this use has dramatically increased over the last 15 years.

Hunting is a very large dispersed recreation activity in Arkansas, especially on public lands. There is tremendous connectivity among generations of families that hunt together. This is evident by the enormous number of deer camps that appear in the fall of each year. Although hunting shows to be a declining trend in the market area, it will still be a very important recreation activity on the OSFNFs. In a recent 2001 report, Arkansas ranked 8th in the United States of total number of hunters, 12th in total number of deer hunters, and 10th in retail sales (*Economic Importance of Hunting in America*).

Hunting success and sustainability is dependant on the quality of wildlife habitat. Other parts of this FEIS describe habitat conditions and proposed changes in different alternatives.

After completion of the OSFNFs recreation realignment process, the Forests developed the following mission statement: "Provide diverse, quality outdoor recreation experiences that reflect the unique or exceptional resources of the Forests and interests of the recreating public on an environmentally sound and financially sustainable basis." (USFS May 2002).

In order to meet future recreation demand and utilize the OSFNFs' unique values in providing outdoor recreation in a dispersed setting, a vision statement was also developed in which the Forests decided to focus on the following: to provide more day use, to develop more sightseeing opportunities, and to provide a variety of trails (including OHV trails that are environmentally sustainable).

Recreation Opportunity Spectrum (ROS)

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. Recreationists choose a setting and activity to create a desired experience. Three components of recreation supply are settings, activities, and facilities; the USFS manages a supply of settings and facilities.

Recreation managers generally concern themselves with managing settings and with determining what types of activities may be appropriate within each setting. To match the diversity of recreation interests with appropriate opportunities, the OSFNFs offer a variety of recreation settings. These settings are differentiated by the amount of development and other attributes incorporated into a recreation-planning tool called the Recreation Opportunity Spectrum (ROS). The Forest Service uses this mapping and classification system to distinguish between different types of recreation settings in the Forests. The ROS system provides a way to help mangers and recreation users understand what recreation experiences to expect and where these are available across the Forests. ROS can help people visualize the variety of natural outdoor settings, the types of activities that can be pursued, and how many other people might be found in a specific area of the Forests.

ROS has been divided into six major classes for Forest Service use

- Primitive (P),
- Semi-primitive non-motorized (SPNM),
- Semi-primitive motorized (SPM),
- Roaded natural (RN),
- Rural (R), and
- Urban (U).

In the 1986 LRMP, the Forests were divided into five of the six ROS classes. These included

- Primitive (P),
- Semi-primitive non-motorized (SPNM),
- Semi-primitive motorized (SPM),
- Roaded natural (RN), and
- Rural (R).

Table 3-134 displays the ROS inventory from the 1986 LRMP.

Definitions of ROS Categories

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 or larger in size. Primitive ROS generally does not exist because no single area is large enough to meet all criteria. The wilderness areas on the OSFNFs were classified as semi-primitive non-motorized in the 1986 Plan since major roads surrounded most of them.

Semi-primitive non-motorized (SPNM) is characterized by an environment where the natural landscape has been subtly modified and where alterations, though noticeable, would not draw the attention of most users. Specific activities are oriented toward both consumptive and non-consumptive use of the land and water resources of the area, including hunting, fishing, hiking, camping, and nature study. Basically these settings accommodate dispersed, non-motorized recreation.

Semi-primitive motorized (SPM) settings are characterized by naturally appearing environment. Concentration of users is low. Motorized use is permitted.

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 (R) management emphasis is for rural and roaded-natural recreation opportunities. These settings represent the most developed sites and modified natural settings on the forest. Motorized and non-motorized recreation, such as driving for pleasure, viewing scenery, picnicking, and fishing are examples.

Urban (U) represents a landscape character that has resulted from extensive human activities, no longer appearing natural, such as conversion of natural landscapes into an extensively altered landscape, such as a town, city or metropolitan area. The 1986 Plan did not use this class.

Table 3-134: Current Distribution of ROS Classes Used in the 1986 Plan.

Recreation Opportunity Spectrum (ROS) Class	Current % Of National Forest	Current Inventoried Acres
P-Primitive (Wilderness on OSFNFs)	0	0
SPNM-Semi-Primitive Non-Motorized	6%	71,000
SPM-Semi-Primitive Motorized	35%	400,000
RN-Roaded Natural	58%	663,000
R-Rural	1%	6,000
Total	100%	1,140,000

The OOHA, Report 4-*Social and Economic Conditions* states that it appears that most the private lands in the region are roaded natural or rural, with some urban settings. The OSFNFs are predominately semi-primitive motorized or roaded natural.

For plan revision, the OSFNFs decided to use a different classification of ROS than was previously used. Table 3-135 shows the current ROS inventory for the new ROS classes. The new classes were used so all the proposed alternatives, including the Current Plan Alternative, could be compared equally,.

Table 3-135: Current ROS Inventory for the New ROS Classes.

Recreation Opportunity Spectrum (ROS) Class	Current Percentage Of National Forest	Current Inventory Acres*
P-Primitive	6%	68,062
SPNM-Semi-Primitive Non-Motorized	1%	6,176
SPM-Semi-Primitive Motorized	<1%	2,682
SPNM-SPM Semi-Primitive Non-Motorized to Semi-Primitive Motorized	NA	0
SPM-RN Semi-Primitive Motorized to Roaded Natural	3%	38,512
RN Roaded Natural	90%	1,054,377
UR-RN Urban to Roaded Natural	0%	
Totals (NF Lands Only)	100%	1,169,809

***These acres are based on GIS mapping and differ from the original 1986 plan acres**

The combined ROS categories in Table 3-135, represent management prescription areas where you would find a combination of the types of experience levels described in the definitions section.

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, visitor centers, 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 Level 1 representing the most primitive, natural settings with minimal or no site amenities and Level 5 representing the highest level of development with fully accessible facilities.

Blanchard Springs Caverns and Lake Wedington are the only Level 5 sites on the OSFNFs. Mt. Magazine and the Mississippi River State Parks, operated under a special use permit with the State of Arkansas, are other examples of Level 5 sites (they are not under FS management). Long Pool and Shores Lake Recreation Areas are examples of Level 4 sites offering paved campsites, bathhouses, and electric and water hook-ups.

Campgrounds such as Bayou Bluff, Ozone, and Natural Dam with vault toilets, designated campsites, and a developed water source are considered Level 3. Campgrounds such as Fairview, Brock Creek, High Bank, and Campbell Cemetery are considered Level 2 sites. Different levels of development may be present within large campgrounds, however, the designated development level represents at least 70 percent of the facility.

Supply of Developed Recreation Sites

The FS defines the capacity of developed recreation sites in terms of "people at one time" (PAOTs) a site can support. Currently, there are over 22 developed sites managed by the OSFNFs to accommodate different recreation activities. Tables 3-136 and 3-137 illustrate the different types of facilities provided across the Forests and their current capacity in PAOTs. See Appendix B for a description of the NVUM process and discussion of recreation visits over time by each alternative.

In 1997, the four forests in the Ozark Highlands (Mark Twain NF in Missouri, and Ozark, St. Francis, and Ouachita NFs in Arkansas) completed an assessment of the entire region in preparation for forest plan revision. This assessment was called *The Ozark-Ouachita Highlands Assessment* (OOHA). Among many of the items inventoried for plan revision was the status of recreation in the region (Figure 3-20).

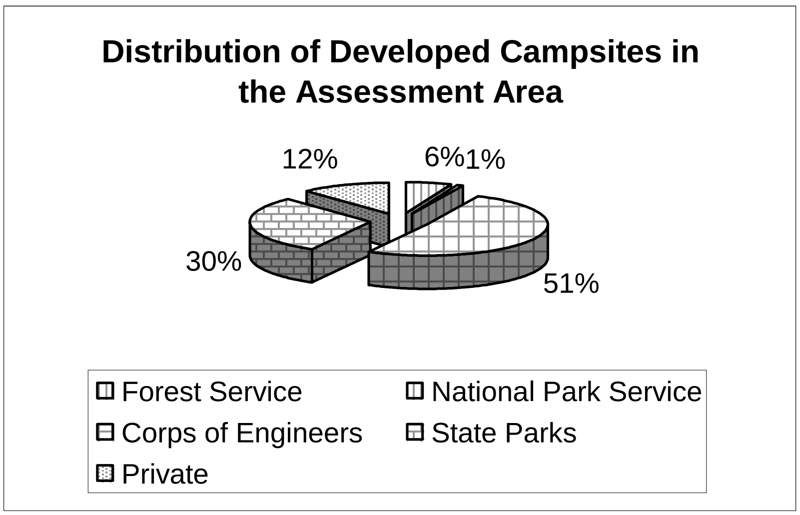

Figure 3-20: shows how developed recreation campsites are currently distributed in the assessment area. The OSFNFs provide approximately 6% of the developed recreation campsites in the assessment area. Data taken from OOHA Chapter 4, Pages 143-144.

Table 3-136: Current Capacities of Day-Use Developed Areas on OSFNFs.

Type of Day Use Developed Areas	Total Number of Areas	Total Capacity (PAOT)
Picnic Areas	6	200
Picnic and Swimming	9	2370
Shooting Ranges	2	60
Minor interpretive sites	1	65
Visitor Centers	1	390
Boat Access	3	60
Total Day-Use Capacity	22	3,145

Table 3-137: Current Capacities of Overnight-Use Developed Sites on OSFNFs.

Level of Campground	Total Number of Campgrounds	Total Capacity (PAOTs)
Level 2 Campgrounds	3 (2 horse camps)	185
Level 3 Campgrounds	12 (1 horse camp)	785
Level 4 Campgrounds	6	650
Level 5 Campgrounds	1	90
Cabins and Lodges	2	150
Total Overnight Capacity	33	1,860

In addition to facilities represented in the tables, there are 52 recreation residences located on the St. Francis NF primarily around Bear Creek Lake.

Many Level 2 campgrounds on the OSFNFs have evolved over time in response to riparian resource degradation and sanitation concerns. These sites have been developed in areas of concentrated use mostly along popular river corridors. Site rehabilitation usually includes discreet delineation of campsites and parking areas as well as the provision of a vault toilet either temporary or permanent. The number of Level 2 campgrounds and day-use sites on the OSFNFs will likely increase as user controls become necessary to mitigate user impacts in popular dispersed sites. Public demands for Level 4/Level 5 campsites currently exceed supply during the weekends on the OSFNFs. Many visitors desire sites that are more accessible and have options for water and electrical hook-ups. Accessible sites and utilities are being provided as older campgrounds are reconstructed. Public use has increased at the upgraded sites, but total site capacity (PAOT) has increased only slightly.

The Lake Wedington Unit is 13 miles from the city of Fayetteville. This part of Northwest Arkansas is expected to see exceptional population growth over the next 15 years. (See Table 3-133 - Fastest and Slowest Growing Counties in the Market Area.) The Lake Wedington Unit is approximately 15,000 acres, and is expected to see great demand in the future for people seeking different recreation experiences. Currently there is one Level 5 campground located at Lake Wedington. There are also some cabins, which are available for rent. Recently, the Ozark NF closed the Wedington Unit to OHV use. There was uncontrolled OHVs use causing considerable resource damage, and affecting the wildlife populations.

Dispersed Recreation

Dispersed recreation is defined as those activities that occur outside of developed recreation sites such as boating, hunting, fishing, hiking, and biking. There are nearly 20 developed recreation sites that facilitate dispersed use of the Forests such as trailheads and boat ramps.

Table 3-138: Developed Access Points for Dispersed Recreation on OSFNFs.

Type of Developed Site	Total Number of Sites	Total Capacity (PAOT)
Trailheads (Facilities)	9	296
Trailheads (CUAs*)	6	60
River Access Points	7	170
Lake Boat Ramps	8	240
Fishing Sites	5	100
Total	28	761

***Concentrated Use Areas**

Table 3-139: Miles of Non-Motorized Trails on OSFNFs.

Type(s) of Trail Use Allowed	Existing Miles of Designated Trails
Hike only	294
Bike only	37
Horse only	106
Horse and Hike only	13
Horse, OHV, Hiking, Mtn. Biking	146
Canoe, Kayak and Raft only	45
Total	642

Table 3-140: Miles of Motorized Multiple Use Trails on OSFNFs.

Type(s) of Motorized Use Allowed	Existing Miles of Designated Trails
Motorcycle only	7.9
ATV only	0
Motorcycle and ATV only	17.7
*Street Legal 4-WD, High Clearance Vehicles and Motorcycles only	207
Total	232.6

***Street Legal Vehicle trails are defined as National Forest System Roads open to the public for at least a part of each year with management objectives of Traffic Surface Level (TSL) D and Maintenance Level (ML) 2.**

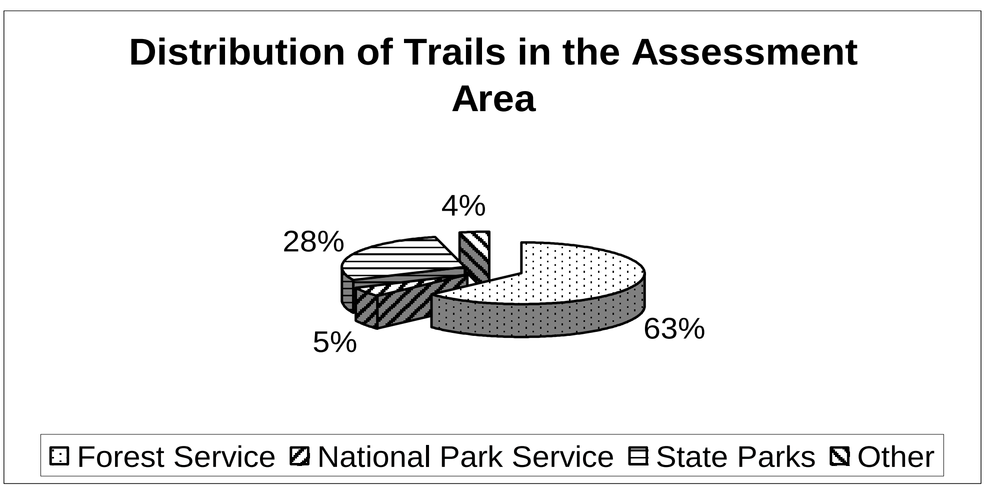

Figure 3-21: OOHA Distribution of Trails, OOHA 1999.

Direct and Indirect Effects

Existing recreation demand is expected to grow for a variety of activities including dispersed and developed recreation. Existing use on the national forests will increase as recreation demand and populations grow over the next 10 years.

General themes were developed for Alternatives A, B, C, D, and E that emphasize different resource management objectives. The OSFNFs recently went through a recreation alignment process, which refocused the Forests' recreation direction more toward day-use activities, trail use, and sight seeing. Much of the developed recreation facilities should support those activities. All of the alternatives will follow the trend toward those activities, but will have different areas of emphasis. Alternative A 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 specific elements (activities, setting, and experiences) be considered.

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 3-141: Estimated Distributions of ROS Classes by Alternative.

Recreation Opportunity Spectrum (ROS) Class	Alternatives				
	A*	B	C	D	E
P-Primitive	68,062	68,062	68,534	68,062	68,534
SPNM-Semi-Primitive Non-Motorized	6,176	6,176	6,176	6,176	6,176
SPM-Semi-Primitive Motorized	2,682	527,692	13,963	7,744	13,963
SPNM-SPM Semi-Primitive Non-Motorized to Semi-Primitive Motorized	0	0	23,960	0	23,215

***Alternative A, Baseline-Current Forest Plan inventory. All other alternatives are based on the management prescription areas, not on existing inventory.**

Table 3-141: Estimated Distributions of ROS Classes by Alternative (Continued).

Recreation Opportunity Spectrum (ROS) Class	Alternatives				
	A	B	C	D	E
SPM-RN Semi-Primitive Motorized to Roaded Natural	38,512	54,223	41,115	38,512	56,828
RN Roaded Natural	1,054,377	503,190	1,016,061	1,049,315	990,626
UR-RN Urban to Roaded Natural	0	10,467	0	0	10,467
Totals (NF Lands Only)	1,169,809	1,169,809	1,169,809	1,169,809	1,169,809

***Alternative A, Baseline-Current Forest Plan inventory. All other alternatives are based on the management prescription areas, not on existing inventory.**

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.

Table 3-141 displays estimated distribution of acres of ROS Classes by Alternative. Alternative A, the current forest plan ROS inventory, is used as a baseline. All other alternatives are proposed ROS conditions contained in different management prescription area desired conditions (See Appendix B for a detailed view of the ROS settings by alternative and management area prescription.)

Alternative B provides a variety of recreation opportunity spectrum settings from the most primitive to more developed. However, the emphasis in this alternative is to provide recreation opportunities in settings that are more remote and less developed, such as primitive, semi-primitive non-motorized, semi-primitive motorized, and areas that contain a range of semi-primitive motorized to semi-primitive non-motorized settings. The acres of more remote settings increase drastically in this alternative by 600 percent over baseline because of the large area of custodial management. In this alternative, acres for more developed settings (roaded natural and urban) decreased by 48 percent. 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.

Within Alternative C, the acres of more remote settings increased 46 percent. Acres for the developed settings decreased about three percent. This alternative would promote both developed and dispersed recreation opportunities. The management prescription areas assigned for pine and hardwood restoration would provide a different but unique setting favoring more open forest conditions.

Alternative D reflects a seven percent increase in more remote settings while acres for more developed settings remain virtually the same over baseline.

Alternative E indicates a 45 percent increase in the more remote settings. Acres for the developed settings decreased only slightly by about three percent. The emphasis

in Alternative E is to provide a high quality recreation experience both in terms of remote backcountry, dispersed, and developed recreation. A variety of recreation uses would occur including concentrated use and off-highway use.

Alternatives B and E showed about a one percent increase in the urban settings (Wedington Unit Urban Recreation Area).

The acres of primitive, semi-primitive, or more remote settings are greatest in Alternatives B, C, and E. 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 A and D. Alternatives. A and D all have moderate increases in remote settings and opportunities. Acres for more developed settings are greatest in Alternatives A and D, and moderate in Alternative E. Acres for more developed settings are least in Alternative B.

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 3-142 shows that all alternatives allow for small increases in PAOTs in the Level 3 and Level 5 campgrounds, and decreases in the Level 2 campgrounds. The Level 2 campgrounds are either closed, or the emphasis shifts from overnight-use to day-use. Alternatives B and E allow most of the expansion and improvements of developed recreation. Each alternative proposes only a moderate increase due the reality of limited fiscal budgets. New developed sites would only be constructed if they were in support of a day-use trail or other type of dispersed activity (i.e., campground to support an OHV trail) and would be designed to focus on that activity. All alternatives provide improvements necessary for public health, safety, and accessibility.

Table 3-142: Estimated Increase in Capacity of Developed Recreation Areas by Alternative.

Type of Development	*Current PAOTs	Alternatives				
		A	B	C	D	E
Day-Use Areas	3145	Low	Moderate	Moderate	Low	Moderate
Level 2 Campgrounds	185	Decrease	Decrease	Decrease	Decrease	Decrease
Level 3 Campgrounds	785	Low	Low	Low	Low	Low
Level 4 Campgrounds	650	Low	Moderate	Low	Low	Low
Level 5 Campgrounds	90	Low	Mod	Low	Low	Moderate

***Baseline = Existing Developed Recreation**
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

Alternative B maximizes capacity by focusing on high quality/cost effective developed recreation sites, maximizing tourism benefits. This is accomplished by expanding and upgrading key Level 3 and Level 4 campgrounds by adding amenities at campsites such as utility hookups, improving or expanding incorporated day-use facilities, and improving accessibility. Some Level 2 and Level 3 campgrounds are rehabilitated and redesigned and converted to day-use or closed if not cost effective. Key horse camps are upgraded and expanded. The Wedington Unit is managed as an urban recreational forest with the campground converted to a Level 5 facility.

Alternative C focuses more on day-use increases associated with the restoration of pine and woodland communities. Some Level 2 and 3 campgrounds are redesigned and converted to day-use for interpretation of these natural areas.

Alternative D is similar to Alternative A but there would be less emphasis on upgrading and expansion to attain higher development levels in campgrounds. Day-use facilities would not be increased or expanded as much as under Alternatives C or E. New day-use and overnight facilities may be constructed at a development level appropriate for the desired ROS setting. However, maintenance and improvements to existing sites will be a higher priority than constructing new facilities.

Alternatives A and D provide the least amount of change in developed recreation. The existing capacity and development levels of recreation sites should remain similar to current conditions. Facility maintenance would focus primarily on improvements necessary for public health, safety, and accessibility. Popular sites would be overused and crowded at peak times such as holidays and weekends. This may lower visitor satisfaction over time. Improvements would be generally more for site and resource protection than providing visitor comfort and convenience.

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.

Hotspots of developed recreation are sites that are consistently at or over their design capacity on certain weekends and holidays. On the OSFNFs, these include areas such as Blanchard Springs, Cove Lake, Long Pool, and the Lake Wedington area. 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 3-143 displays the estimated increase in motorized and non-motorized trails by alternative. Table 3- 144 displays the designated OHV areas by alternative.

Table 3-143: Estimated Increase in Motorized and Non-Motorized Trails by Alternative.

Type of Trail	*Existing Trail Miles	Alternatives				
		A	B	C	D	E
Hike only	294	Low	Mod	Mod	Low	Mod
Bike only	37	Low	Low	Mod	Low	Mod
Horse only	106	Low	Mod	Low	Low	Mod
Horse and Hike only	13	Low	Low	Mod	Low	Mod
Motorcycle and Bike only	35	Low	Low	Low	Low	Low
Horse, OHV, Hiking, Mtn. Biking	146	Low	Mod	Low	Low	Mod
Canoe, Kayak and Raft only	45	Low	Low	Low	Low	Low

***Baseline = 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 3-144: Designated OHV Areas (in Miles) by Alternative.

Type of Motorized Use	Alternatives				
	A*	B	C	D	E
Designated OHV Areas	146	Low	Low	Low	Low

Table 3-145: Developed Access Points for Dispersed Recreation on the OSFNFs.

Type of Developed Site	*Existing Trail Heads	Alternatives				
		A	B	C	D	E
Trailheads (Facilities)	9	Low	Mod	Low	Low	Mod
Trailheads (CUA**)	6	Low	Mod	Low	Low	Mod
River Access Points	7	Low	Low	Low	Low	Low
Lake Boat Ramps	8	Low	Low	Low	Low	Low
Lake Campsites/ Boat Tie Ups	0	Mod	Mod	Low	Low	Mod
Courtesy Docks	0	Mod	Mod	Low	Low	Mod
Fishing Sites	5	Low	Mod	Low	Low	Low

***Baseline =Existing Sites**
****CUA=Concentrated use areas**
Low increase= < 5% increase of sites
Moderate increase = 6-25% increase of sites
High increase = > 26% increase of sites
Decrease = any net loss of existing sites

Each alternative proposes only a low-moderate increase in trail systems due the reality of limited fiscal budgets. All alternatives provide improvements necessary for public health, safety, and accessibility. Alternatives B and E show a greater increase in most trail systems due to a greater 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, and law enforcement needs. Alternatives A and D keep the current trails system. This can lead to resource impacts if there is significant unmet demand for that particular activity.

There are little planned increases in motorcycle or river trails in all alternatives. This can lead to overuse and resource impacts if there is substantial unmet demand for these types of trails. 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.

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 Forests. The greatest increases in equestrian trails occur in Alternatives B and E. Alternatives A, C, and D propose only slight increases in equestrian trails. This can lead to overuse and resource impacts if there is substantial unmet demand. Also, equestrian trails are often multiple uses allowing hiking, mountain biking, and OHVs on the same trails. Occasionally, this can lead to user conflicts. Cross-country equestrian use is allowed in all alternatives since there are no restrictions on horse use in the general forest area or closed road systems. (There is one exception, no horses are allowed on the Ozark Highlands Trail.)

The greatest increases in OHV trail opportunities occurs in Alternatives B and E. Alternatives A, C, and D propose only slight increases in OHV trails. 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 opportunities 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 Forests. Alternatives B and E will show the greatest increase in cross-forest 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 Forests. The greatest increases in mountain biking trail opportunities occur in Alternatives B and E. Alternatives A, C, and D propose only slight increases in 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 uses allowing hiking and equestrian use on the same trails. Occasionally, this can lead to user conflicts.

Increases in interpretive trails (which are usually on existing hiking trails) enhance experiences for most visitors. Sharing information about ecosystems, history, and resource management through interpretation leads to better-informed visitors, which often results in good partners in management.

All alternatives show slight increases in dispersed recreation access points, such as boat ramps, canoe launch sites, and trailheads. The greatest increase in access points comes in Alternatives B and E. All other alternatives show only a slight increase in dispersed recreation access points.

All alternatives show a slight increase in fishing sites due to the recreation alignment refocus of direction at our lakeside-developed sites. Alternatives B and E would have a moderate increase because of the additional emphasis on low cost/high use sites under those alternatives.

Alternatives that allocate additional acres to big and small game emphasis areas will increase the hunting and wildlife viewing experiences. Table 3-146 displays the allocation by acres by alternative to these areas.

Table 3-146: Estimated Total Acres (1st Decade) of Wildlife Emphasis by Alternative.

Type of Game Habitat	Alternatives				
	A	B	C	D	E
Woodland Habitat	53,428		267,122		252,333
High Quality Wildlife Habitat		15,712			15,712
Permanent Openings	No Change	Increase	Decrease	Increase	Slight Increase
Early Successional Forest Habitat	42,887	78,307	54,320	120,000	34,575
Total	96,315	94,019	321,442	120,000	302,620

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 Forests. Alternatives C and E have the largest amount of acreage in habitats that benefit big and small game hunting. Acres of habitat management for big and small game hunting are least in Alternatives A and B. Alternative D is in-between. Increases in non-consumptive hunting habitat are greatest in Alternatives C and E; however, Alternative B does have a high quality wildlife emphasis area that will provide wildlife viewing. Effects on hunters, both small and big game, will generally be positive. Some specific areas on the Forests will not be managed for game species as they 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.

Recreation Activities

The recent recreation alignment process developed a niche statement which refocused the Forests' recreation direction more toward day-use activities, trail use, sight seeing, and developed recreation facilities supporting those activities. This would mean that any newly constructed or rehabilitated developed recreation facilities would be in direct support of one of those types of uses or activities. As an example, a proposed campground would have to be in support of a OHV trail, swimming, fishing, or some other primarily day-use activity. All of the alternatives will continue to follow that trend, but will have different areas of emphasis. Table 3 147 shows how the alternatives meet the estimated trend changes for the current most popular recreation activities on the OSFNFs.

Table 3-147: Predicted Activity Trends by Alternative.

Recreation Activity	Alternatives					2010*	2020*
	A	B	C	D	E		
Developed Camping	Low	Mod	Low	Low	Mod	27%	60%
Backpacking	Low	Low	Low	Low	Low	23%	57%
Visit Historic Sites	Low	Low	Low	Low	Low	22%	47%
Visit Wilderness or Primitive Areas	Low	Low	Mod	Low	Mod	22%	47%
View Wildlife	Low	Mod	Mod	Low	Mod	21%	46%
Day Hiking	Low	Low	Mod	Low	Mod	19%	38%
View/Photograph Nature or Scenery	Low	Mod	Mod	Low	Mod	15%	31%
Driving for Pleasure	Low	Mod	Low	Low	Mod	15%	31%
Mountain Biking	Low	Low	Mod	Low	Mod	12%	26%
Horseback Riding	Low	Low	Mod	Low	Mod	9%	19%
Drive Off-Road	Low	Mod	Low	Low	Mod	5%	10%
Canoeing/Kayaking	Low	Low	Low	Low	Low	1%	3%
Primitive Camping	Low	Low	Low	Low	Low	-2%	0%
Hunting	Low	Low	Low	Low	Low	-3%	-7%
Picnicking	Low	Low	Low	Low	Low	11%	23%
Fishing	Low	Low	Low	Low	Low	9%	17%
Swimming	Low	Low	Low	Low	Low	6%	13%

***Percent increases over current for the years 2010 and 2020 are projected trends for the OSFNFs market area. Some activity projections for the forests may differ from the market area.**
Low increase = < 5% increase in existing visits.
Moderate increase = 6-25% increase in existing visits
High increase = > 26% increase in existing visits.
Decrease = any net loss in existing visits

The effects of the alternatives on some activities would be negligible because the activities are currently close to capacity, or nothing in the proposed alternatives would change conditions to increase or decrease these activities. There would be little to no change in swimming opportunities since all of developed sites on the Forests' lakes and rivers currently provide swimming opportunities and there are no currently anticipated additions to those opportunities. Picnicking and fishing would both have low increases in participation as the Forests follow the recreation alignment recommendations, which emphasized those activities. The participation would probably remain low since most of the current developed sites already provide for those activities where appropriate and capacity has not been filled for the most part.

Alternative A would provide no change or low change in existing visits to the Forests for any of the recreation related activities since there would be little or no change in the management area allocations. Following the recreation alignment recommendations there would be no increases in opportunities for developed camping except in cases where it directly supported a day-use activity such as swimming or biking.

Alternative B would provide some increases in opportunities for some activities primarily developed camping and mountain biking. The addition of the Lake Wedington Urban and Recreational Forest will provide most the increase. The Forests anticipate additional opportunities in this area since this alternative would emphasize high-use, low cost facilities in support of tourism. Moderate increases in wildlife viewing, viewing/photographing nature or scenery, driving off-road and driving for pleasure should increase. Low increases in day hiking, mountain biking, picnicking, horseback riding, fishing, and canoeing/kayaking should also occur. There may be a low increase in developed camping as those sites are rehabilitated or developed for support of those increasing activities. No change would be anticipated in the number of visits related to backpacking, historic sites, wilderness, primitive areas, swimming, motor boating, primitive camping, and hunting since this alternative would not emphasis or add areas specific to these activities.

Alternative C adds three new areas, which would have an effect on the recreation activities occurring in the Forests. The addition of the Upper Buffalo and Indian Creek Dispersed Recreation areas will probably create moderate increases in backpacking, visits to wilderness or primitive areas, wildlife viewing, day hiking, viewing/photographing nature or scenery, mountain biking, and horseback riding activities. These additions would also create a low increase in primitive camping, which is trending downward in our market area. This alternative would see a low increase in developed camping since facilities would be developed only in support of those day-use related activities. Hunting may see a low increase related to the restoration of the ecosystem and anticipated improvement in game species. The addition of the Illinois Bayou to the Wild and Scenic River System may increase the canoeing and kayaking on the forest as access points on that river are developed.

Alternative D would be similar to Alternative A. Since the emphasis in Alternative D for recreation is to provide a variety of recreation opportunities it is anticipated that there would be low increases in most and no change in some since the alternative adds no opportunities to increase them. No change would be anticipated in participation in backpacking, visiting historic sites, wilderness or primitive area visits, wildlife viewing, primitive camping or hunting. Low increases would be anticipated in day hiking, viewing/photographing nature and scenery, driving for pleasure, horseback riding, and driving off-road.

Alternative E provides for a variety of recreation opportunities based on high use/low cost activities. It includes the Upper Buffalo and Indian Creek Dispersed Recreation Areas, recommends the North Fork of the Illinois Bayou as a Wild and Scenic River, and adds scenic by-ways to the existing forest system. Most of the activities listed will show increases in visits ranging from low to moderate. Activities with a low increase are historic site visits (emphasis in this alternative on heritage interpretation), wilderness or primitive area visits, primitive camping and canoeing/kayaking (added areas), and finally hunting. Those activities in which moderate increase in visits would be expected include developed camping (in support of increased day-use and sightseeing activities), backpacking (added primitive areas), wildlife viewing, day hiking, viewing/photographing nature and scenery, driving for pleasure, mountain

biking, horseback riding, and driving off-road. This alternative provides the widest array and the greatest potential for increase in forest recreation visits.

Cumulative Effects for Recreation Related Programs

A discussion on cumulative effects of the alternatives presented in this FEIS examines how social and land use trends on public and private lands in the OSFNFs together influence the healthy and sound management of USFS 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. Due to the aging population, the demands for less physically challenging activities (the demands for developed or improved settings) are likely to rise faster than demands for remote and primitive settings.

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 OSFNFs. 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.

The ability for the public to recreate on private lands is changing. About one-quarter (¼) of private landholders in the Ozark Highlands provide access for the recreating public for certain compatible activities. Over time, however, less private land is predicted to be available. 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 their waterways. Use is exceeding capacity and public access provided by private lands for water recreation is diminishing. Therefore, a general trend on private lands surrounding the OSFNFs 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 increasing recreation demand.

Related to recreation demand are tourism and its importance to gateway communities and regional economies. Many communities are encouraging tourism that centers on using the attractions of national forest to stimulate their local economy. The Mt. Magazine State Park and the Mississippi River State Park are two examples of recent developments that have been promoted by local communities.
Finally, nature-based settings are key ingredients for enhancing a sense of place in the Ozark Highlands 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. Conflicts between user groups will continue to arise between long-time residents and new development related to tourism and outdoors recreation including the management of motorized versus non-motorized recreation settings.

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, who bring more impacts to the natural settings and want more user conveniences, recreate on the OSFNFs. Alternatives B, C, and E emphasize the provision of a diverse range of recreation opportunities throughout the Forests with Alternative B promoting the greatest expansion of developed recreation. Alternatives B, C, and E propose the largest increase in designated wild and scenic rivers, scenic byways, special interest areas, and special dispersed recreation areas. They create more remote settings and challenging outdoor recreation opportunities. Alternatives A and D emphasize other values on USFS land; therefore, provide less 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) required for the 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.

WILDERNESS/ROADLESS

Affected Environment

Congressionally designated wilderness areas are protected by law and valued for their ecological, historical, scientific, and experiential resources.

Outdoor recreation is one of the benefactors of wilderness and is one of the drivers of wilderness management. According to trend data collected from 1965-1994, recreation visits to NF wilderness has paralleled designations and increased over time. Participation rates and trends in visiting wilderness areas indicate a continued increase with an estimated 7,860,000 visits to wilderness by the year 2050.

In addition to outdoor recreation in wilderness, there is a non-user component that values American wilderness and is important to understand when analyzing

wilderness and roadless allocations. 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) had the question, "How do you feel about designating more federal lands in your state as wilderness?" Seventy percent (70%) of those surveyed were 'in favor" or "strongly in favor" with the idea of having more wilderness designated in their state. Over 96 percent agreed or strongly agreed with the statement, "I enjoy knowing that future generations will be able to visit and experience wilderness areas."

Currently, there are five designated wilderness areas on the OSFNFs (all are located on the Ozark National Forest) containing a total of 66,728 acres. The OSFNFs do not contain any wilderness study areas or recommended wilderness study areas that have not been acted upon by Congress (Table 3-148). The existing wilderness areas will be managed to maintain the areas' natural characteristics. Natural occurrences such as outbreaks of insects or disease are allowed as part of the natural cycle. Man-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. Each wilderness has an implementation plan. No plan allows for prescribed burning in the wilderness areas.

Wilderness Demand

A wilderness-needs study was completed to assess the current demand on existing wilderness areas and to project potential future demand for additional wilderness. An accessibility evaluation was completed to determine if major population centers (urbanized or metro areas of 50,000 or more persons as defined in the Census of Population and Housing, US Department of Commerce, Economics and Statistics Administration, Bureau of the Census) within the Forests' 250-mile draw area were served by at least one wilderness area. (see process file for complete analysis results). All metropolitan areas located inside the Forests' draw area have excellent access to wilderness areas on the OSFNFs.

Table 3-148: Existing Wilderness Areas

Wilderness	District	Acres	Year Designated
East Fork	Bayou	10,688	1984
Hurricane Creek	Buffalo	15,307	1984
Leatherwood	Sylamore	16,838	1984
Richland Creek	Buffalo	11,801	1984
Upper Buffalo	Buffalo	12,094	1975
Totals		66,728	

Note: Acreages are from Wilderness.net

According to the Forests' National Visitor Use Monitoring (NVUM) study, current use on the Forests is approximately 12,000 visits. This is expected to increase steadily over time (see Table 3-149).

Table 3-149: Projected Increase in Wilderness Use on the OSFNFs.

Recreation Activity	2010 Increase	2020 Increase	2030 Increase	2040 Increase	2050 Increase
Visit Primitive or Wilderness Areas	25%	57%	96%	108%	171%

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, where any signs of prior human activity are disappearing or being muted by natural forces. Criteria provide for an individual roadless area to include no more than one-half mile of improved road for each 1,000 acres.

Congress established the National Wilderness Preservation System under the 1964 Wilderness Act. The Act required agencies to study other lands for wilderness characteristics. In 1972, the FS completed the first Roadless Area Review and Evaluation (RARE I). In 1979, the FS completed the second Roadless Area Review and Evaluation (RARE II) and published a FEIS recommending areas for wilderness, non-wilderness, and further planning (Table 3-150).

Table 3-150: 1979 RARE II Inventory Results for the OSFNFs.

Areas Recommended for Wilderness	Areas Recommended non Wilderness	Areas Recommended for Further Planning
Hurricane Creek	Clifty Canyon	Richland Creek
Upper Buffalo Addition	Devils canyon	
	Dismal Creek	
	East Fork	
	Gee Creek	
	Indian Creek	
	Leatherwood	
	Pedestal Rocks	
	Penhook	

RARE II recommended two areas for wilderness on the OSFNFs: Hurricane Creek and an addition to the Upper Buffalo Wilderness, which had been designated in 1975. Congress used the information from RARE II, conducted their own review, and then designated four additional wilderness areas on the OSFNFs in the 1984 Arkansas Wilderness Act. Specific language in RARE II and the 1984 Arkansas Wilderness Act stated areas that designated non-wilderness should be allocated to other multiple uses. The remaining portions of the RARE II areas (those outside the designated wilderness boundary) were analyzed in the Forest Plan FEIS and allocated to other types of management. Table 3-151 shows the remaining RARE II areas after wilderness designation.

Table 3-151: Remaining RARE II Areas.

Non Wilderness Rare II Areas	Acres
Clifty Canyon	2,051
Devils Canyon	1,819
Dismal Creek	9,612
East Fork	12,900
Gee Creek	7,948
Hurricane Creek	2,345
Indian Creek	7,836
Leatherwood	182
Pedestal Rocks	21,604
Penhook	6,579
Richland Creek	421
Totals	73,297

In the forest planning process, national forests are required to assess roadless areas on a forest (Chapter 7 of FSH 1909.12). A new roadless inventory was conducted as a part of this plan revision (see Appendix C, Roadless Area Evaluations). The entire OSFNFs, including all the original remaining RARE II areas were analyzed according to the criteria outlined in Chapter 7 FSH 1909.12 to determine if roadless characteristics exist to recommend further study as possible wilderness areas.

As a result of this analysis, it was determined that no areas exist on the OSFNFs, including the original RARE II areas or adjacent lands, that currently meet the criteria for inclusion in the roadless area inventory (see Appendix C, Roadless Inventory for an analysis of remaining RARE II areas). The remaining RARE II areas were added to different management areas in the different alternatives (Table 3-152). There have been approximately 471 acres of acquired lands next to wilderness that are considered in different alternatives as possible wilderness additions.

Table 3-152: Allocation of 1979 RARE II Areas in Management Areas by Alternative

Management Areas	Alternatives				
	A	B	C	D	E
	Unit of Comparison- 1979 RARE II Acres* Allocated to Management Prescription Areas				
0.A. - Custodial Management		22,012			
1.B - Wilderness Additions			239		239
1.C. - Designated Wild and Scenic Rivers	161	161	161	161	161
1.D. - Recommended Wild and Scenic Rivers		1,855	1,855		1,855
1.G. - Special Interest Areas	7,465	7,465	7,465	7,465	7,465
1.H. - Scenic Byway Corridors	890	890	890	890	2,017
2.A. - Ozark Highlands Trail	347	347	347	347	347
2.C. - Developed Recreation Areas	28	699	28	28	28
2.F. - Indian Creek Dispersed Recreation Area		7,460	7,836		7,836
3.A. - Pine Woodland			200		200
3.B. - Oak Woodland	3,631		15,124		15,123
3.C. - Mixed Forest	61,548		25,433		13,236
3.D. - Oak Decline Restoration Areas		13,178	13,178	14,608	13,178
3.E. - Forest Products Emphasis Areas		19,177	489	49,744	11,559
3.I. - Riparian Corridors		826	826	826	826
3.J. - Pastures and Large Wildlife Openings	65	48	48	48	48

***Note: All acres are estimates calculated using GIS.**

Environmental Consequences

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 negative impacts are

- Soil compaction,
- Vegetation loss or disturbance and replacement by non-native species such as noxious weeds on trails and at campsites,
- 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 that impact the integrity of the natural systems in wilderness are

- 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 any of the five existing designated wilderness areas on the Ozark NF 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. (See the discussion below.)

Proposed Wilderness Additions (1.B). Designation as a wilderness addition would preserve additional areas. These areas would be managed to allow natural processes to occur, provide areas for solitude and primitive recreation, and minimize the effects of man and his activities on the land. These areas would be islands within the Forests where the naturalness, uniqueness, and representative ecosystems of the designated areas will be maintained. Managing for the naturalness of the area is the highest priority for management.

Wilderness additions are set aside for future designation as wilderness in Alternatives C and E, and are not available for activities such as vegetative management or road construction. These areas are managed 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. These areas are not proposed as wilderness additions in the other alternatives, and are allocated to other management areas with different emphasizes. Areas proposed for wilderness addition are displayed in Table 3-153.

Table 3-153: Acres Allocated for Recommended Wilderness Additions by Alternative (MA 1.B).

Wilderness	Alternatives				
	A	B	C	D	E
	Acres				
East Fork			121		121
Leatherwood			334		334
Richland Creek			16		16
Totals			471		471

Direct effects of managing these areas as wilderness additions include maintaining soil, hydrologic, and atmospheric conditions prevailing within 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 man's influence will not increase or will diminish over time. Since these areas are adjacent to existing wilderness, the additions will improve wilderness boundaries, and enforcement of wilderness values.

Although the acreages are very small, opportunities for solitude and remoteness within the wilderness areas will increase, as will the opportunity for primitive and unconfined recreation due to road closures and prohibiting 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. Additional acreage for wilderness additions will increase the carrying capacity and allow 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, OHVs, and other forms of recreation requiring motorized transport or mechanized equipment will result. 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.

WILD AND SCENIC RIVERS

Affected Environment

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 Wild and Scenic Rivers Act.
Rivers and stream corridors on the OSFNFs accommodate many 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. Trends on the OSFNFs indicate approximately a 10 to 20 percent increase rafting, kayaking, and canoeing over the next 10 to 20 years (National Visitor Use Monitoring Report, Appendix B).

In April 1987, the Forests completed Amendment 2 to the Forest Plan, which said all the rivers identified during the National Rivers Inventory identified in the original plan are eligible for study as potential wild and scenic rivers. The Amendment went on to classify each river into wild, scenic, or recreational segments. It also established management direction for those rivers until a suitability study could be completed. The Forests completed the suitability study in 1991. The FEIS and study report evaluated 13 rivers, and recommended 6. The chosen alternative (Alternative 4) of the suitability study used the number of outstandingly remarkable values, and the results of public scoping as criteria to determine what rivers to include as recommended. On April 23, 1992, Congress amended the Wild and Scenic Rivers Act, adding the six recommended rivers into the Wild and Scenic Rivers System. These rivers include: North Sylamore Creek, Big Piney Creek, Hurricane Creek, Mulberry River, Richland Creek, and the Buffalo River.

The total miles of Wild and Scenic River designation on the OSFNFs are 164.6 miles. Table 3-154 displays the miles in each segment of each existing Wild and Scenic River.

Table 3-154: Existing Wild and Scenic Rivers on the OSFNFs.

River	Miles of River by Category		
	Wild Section	Scenic Section	Recreational Section
Big Piney Creek		45.2	
Buffalo River	9.4	6.4	
Hurricane Creek	2.4	13.1	
Mulberry River		19.4	36.6
North Sylamore Creek		14.5	
Richland Creek	5.3	11.2	
Totals	17.1	109.8	36.6

Congress designated these river segments and their associated corridors as a part of the National Wild and Scenic Rivers System. They are managed to enhance and protect the outstandingly remarkable values and unique qualities of each river and its surroundings. The rivers will be preserved in a free-flowing condition for the benefit, use, and enjoyment of present and future generations. Each one of these rivers has a comprehensive Wild and Scenic River Plan, completed in 1996. The plans provide overall management direction for each river.

The Wild and Scenic River Study Report and Final Environmental Impact Statement on Thirteen Rivers (WSRFEIS) in the Ozark National Forest lists the following Outstandingly Remarkable Values for each river (Table 3-155).

Table 3-155: Outstandingly Remarkable Values of the Wild and Scenic Rivers on OSFNFs.

River	Scenic	Recreational	Geological	Fish & Wildlife	Botanical	Wilderness
Big Piney	X	X	X	X	X	
Buffalo River	X					X
Richland Creek		X	X		X	X
Mulberry River		X		X		
Hurricane Creek	X				X	X
North Sylamore Creek		X		X		X

Data source, WSRFEIS Pages 3-7

Following is a description of each of the Wild and Scenic Rivers on the OSFNFs:

Big Piney Creek. This creek is 45. 2 miles long, and flows through Johnson, Newton, and Pope Counties. Big Piney flows from its headwaters, two miles southeast of Fallsville to its confluence with the Arkansas River. A number and variety of roads access the river corridor. State Highway 123 has a bridge crossing Big Piney Creek at Ft. Douglas. Several county roads cross the river corridor. There are a variety of lesser-used forest roads, which provide access to the river, dispersed camps, other national forest lands, as well as to private land. The popular Long Pool Recreation Area is located on the lower section of this river. Canoeing, camping, swimming, and fishing are the primary forms of recreation. Big Piney is an extremely popular canoeing river with Class I to Class III rapids. This river is one of the major smallmouth bass rivers in Arkansas.

Scenic values on Big Piney include highly varied and dissected terrain with uneven sharp ridges and cliffs with significant relief; large unusual rock outcrops or formations; and slopes greater then 35 percent. The river has distinct deep clear pools with reflective qualities, waterfalls, and rapids. Bluff lines are evident along much of the river. Some plant species considered by the Arkansas Heritage Commission to be sensitive are located in the corridor. One species, Alabama snow wreath, is currently under study for listing as a threatened and endangered species.

Big Piney was selected because of its recreational, fish and wildlife, scenic, botanical, and geologic outstandingly remarkable values.

Buffalo River. The Wild and Scenic segments of the Buffalo River are 15.8 miles long, and are located in Newton County in northwestern Arkansas on the Buffalo Ranger District. Nearby communities are Boxley, Edwards Junction, Fallsville, Mossville, and Red Star. The Buffalo River flows generally west to east for 150 miles, beginning in the Boston Mountains, and crossing the Salem and Springfield Plateaus before its confluence with the White River.

The headwaters of the Buffalo River fall entirely within national forest lands. Beginning at a point approximately 16 miles from its headwaters, the Buffalo River was congressionally designated as the Buffalo National River. This 95,730-acre unit of the National Park System was established in 1972 for the benefit and enjoyment of present and future generations. It was established for the purposes of conserving and interpreting an area containing unique scenic and scientific features as well as preserving as a free-flowing stream an important segment of the Buffalo River in Arkansas. The USFS portion is essentially the headwaters of the Buffalo National River.

The wild segment is 9.4 miles long, and is within Upper Buffalo Wilderness. This wilderness is the only wilderness within the Ozark NF that is designated as a Class I Air Quality Area. The terrain is highly varied and strongly dissected with uneven, sharp ridges and/or cliffs with significant vertical relief; large unusual rock outcrops or formations, and slopes greater than 35 percent. The stream is clear and exhibits rapids and still pools with reflecting qualities.

The Buffalo River was selected because of its wilderness and scenic outstandingly remarkable values

Hurricane Creek. It is 15.5 miles long and located in Johnson and Newton Counties in northwestern Arkansas on the Buffalo Ranger District. Nearby communities are Deer, Cowell, and Pelsor. It is approximately three miles west of Pelsor and 40 miles north of Russellville. Primary access is through various forest roads. A tributary to Big Piney Creek, this stream flows through the Hurricane Creek Wilderness.

The upper sections of Hurricane Creek flow through the Hurricane Creek Wilderness, which was designated by Congress in 1984. Bristle-Fern, which is listed as threatened by the Arkansas Natural Heritage Commission, is located within the river corridor inside Hurricane Creek Wilderness. Topography within either side of Hurricane Creek and its side drainages is quite rugged and scenic. Sharp ridges and cliffs, unusual rock formations, and clear reflecting pools characterize its outstanding scenery. The stream is clear and exhibits interesting ripple-pool patterns meandering through richly diverse vegetation with dominant overstory of beech in some reaches.

Hurricane Creek was selected because of its botanical, wilderness, and scenic outstandingly remarkable values.

Mulberry River. This river is located in Newton, Johnson, and Franklin Counties. The Mulberry River flows 56 miles from its headwaters, 2.5 miles south of Fallsville, to its confluence with the Arkansas River. Forest roads and State Highway 215 provide the major access to the river. The most commonly used access points include; Arkansas Highway 103 near Oark, Wolf Pen Recreation Area (the confluence of the Little Mulberry and the Mulberry River), High Bank Canoe Access, Byrd's Campground (private) at Beech Grove, Redding Recreation Area, and Turner Bend Campground (private) at Highway 23. Numerous structures on private land along the river include houses, barns, mobile homes, and poultry houses.

Canoeing, camping, swimming, and fishing are the primary forms of recreation. The Mulberry is one of the premier smallmouth bass fisheries in the Boston Mountains. The AGFC has recognized this river as one of the premier smallmouth and spotted bass fisheries in Arkansas. The Arkansas Smallmouth Bass Management Plan (May 1995) recognized the Mulberry River, as a "quality stream" for smallmouth bass fisheries. The Mulberry is an extremely popular canoeing river with Class I to Class II rapids. Eagles can be seen feeding along the river during migration periods. The state legislature has designated the Mulberry as a state scenic river.

The Mulberry was selected because of its recreational and fish and wildlife outstandingly remarkable values.

North Sylamore Creek. This creek flows 14.5 miles and is located in Stone County in north central Arkansas within the Sylamore Ranger District. It is accessed from Barkshed Recreation Area by Forest Service Road 1112 and Forest Service Road 1108. Camping, swimming, and hiking are the primary forms of recreation. Blanchard Springs Recreation Complex attracts many visitors to the creek area. Barkshed Recreation Area and Gunner Pool Recreation Area also are popular recreation sites. North Sylamore Hiking Trail parallels the creek from Barkshed Recreation Area to the south boundary of the district near Allison.

North Sylamore Creek flows between limestone bluffs and offers outstanding scenery, crystal-clear water, secluded swimming holes, and good fishing. It has exceptionally high productivity (pounds of biomass/acre), and supports a high diversity of fish species. The creek is a very productive smallmouth bass fishery. Endangered species of bats utilize the stream corridor for foraging. Several plant species listed as sensitive by the Arkansas Natural Heritage Commission are located along the stream corridor with the largest concentrations being within the Clifty Canyon Special Interest Area, which lies just north of the river corridor.

North Sylamore Creek was selected because of its recreational, fish and wildlife, and botanical outstandingly remarkable values.

Richland Creek. The wild and scenic portion of Richland Creeks is 16.5 miles long, and is located in Newton and Searcy Counties. The entire creek flows 29.6 miles northeast to its confluence with the Buffalo River near Woolum. Richland Creek Falls, Twin Falls, upland swamp, fossiliferous limestones, and smallmouth bass fishing are some of the features of this Ozark Mountains stream as it flows through the Richland Creek Wilderness. Canoeing, kayaking, horseback riding, camping, picnicking, swimming, and fishing are the primary forms of recreation. Richland Recreation Area is heavily used during the summer months due to swimming and fishing holes that are popular with local residents. The exposed bedrock of the river displays geological formations, which are very important to understanding the stratigraphic synthesis of north Arkansas. Exposed fossiliferous limestones and shales seem to represent some of the youngest Mississippian age rocks in North America.

Richland Creek was selected because of its recreational, geologic, wilderness, and botanical outstandingly remarkable values.

Environmental Consequences

Direct and Indirect Effects

Eligibility

The identification of a river for study or recommendation through the forest planning process does not trigger any protection under the Wild and Scenic River Act until designation by Congress. Identifying rivers as eligible, or eligible and suitable, does not create any new agency authority; rather, it focuses the management actions within the discretion of the Forest Service on protecting identified river values.

For agency-identified study 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. 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.

In general, the free flowing condition and outstandingly remarkable values (ORVs) determined for the affected eligible rivers will be protected under all alternatives regardless of recommendations from suitability studies. River corridors have been allocated to prescriptions that adequately protect or enhance the identified ORVs and free flowing condition.

The suitability study for rivers on the OSFNFs was completed in 1991. The WSRFEIS selected Alternative 4 as the preferred alternative. That alternative used the number of outstandingly remarkable values as a measure to determine what rivers to recommend for designation. Of those rivers not recommended, only one river had circumstances that changed enough for the OSFNFs to complete another review for recommendation. The North Fork of the Illinois Bayou had enough outstandingly remarkable values to have been recommended for designation in 1991. At that time the river was under consideration for a water impoundment by the city of Russellville. That proposal was dropped years ago. The city built a reservoir on Huckleberry Creek for water supply. The outstandingly remarkable values still exist for the North Fork. Some of the alternatives recommend it as a wild and scenic river.

The WSRFEIS did not recommend Cole Fork Branch, Falling Water Creek, and the East Fork of the Little Buffalo for wild and scenic river designation. The study pointed out Cole Fork Branch was inside the Clifty Canyon Special Interest Area, which provided adequate protection of the outstandingly remarkable values for that river. The existing SIAs, including Clifty Canyon are addressed in all alternatives in the Revised Forest Plan under Management Area 1.G (Special Interest Areas). This management area will continue to provide adequate protection of the river's values. For these reasons, Cole Fork Branch is not being considered for recommendation. Falling Water Creek and the East Fork of the Little Buffalo were not recommended because they didn’t have enough outstandingly remarkable values to warrant

recommendation; this situation has not changed, these rivers are not recommended. The OSFNFs reviewed other rivers considered during that study as well, and nothing has changed for any further recommendations.

Eligible Rivers Recommended for Designation

Table 3-156: Rivers Recommended for Inclusion as National Wild And Scenic Rivers.

River	Wild Segment	Scenic Segment	Recreational Segment
North Fork - Illinois Bayou		22.6	

Management emphasis for the 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 ORVs for the North Fork of the Illinois Bayou include (WSRFEIS, pages 3-1 and 2):

- **Scenic** – The surrounding terrain on this river is characterized by highly varied and strongly dissected terrain with uneven, sharp ridges and cliffs with significant vertical relief, large unusual rock outcrops or formations, and slopes greater than 35 percent. The stream is clear, with Class II and III rapids.
- **Botanical** – An upland swamp containing overcup oak, buttonbush, and sweetgum exists within the corridor. This upland swamp is an important botanical, soils, and geologic resource because it may help in understanding the physiographic and phytogeographic history of the Ozarks.
- **Fish and Wildlife** – Arkansas game and Fish Commission considers this river to be an outstanding sports fishery.

Table 3-157: Number of Miles of Eligible Rivers by Classification by Alternative.

Miles of Scenic Classification	Alternatives				
	A	B	C	D	E
		22.6	22.6		22.6

Alternatives B, C, and E are the only alternatives that consider the North Fork of the Illinois Bayou. These alternatives would add 22.6 miles of river to the wild and scenic river system, which favors those that want to experience rivers in that designation. Alternatives A and D would favor more of a multiple-use prescription of the river for those who prefer a broader designation. All other rivers would be part of Management Area 3.I (Riparian Corridors). This management area provides adequate protection for all rivers not recommended as wild and scenic.

SPECIAL AREAS

Affected Environment

Special Interest Areas

This section includes special interest areas (SIAs), scenic byways, and experimental forests.

The Forest Service is committed to protect and, where appropriate, foster public use and enjoyment of areas with scenic, historical, geological, botanical, zoological, paleontological, archeological, or other characteristics. Special interest 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.

Table 3-158 identifies 17 SIAs that currently exist on the OSFNFs. These areas were identified in the 1986 Ozark-St. Francis National Forests LRMP as MA 7. These SIAs were designated because of their unique geological, botanical, or scenic resources that are different than the rest of the Forests. Originally, there were 18 SIAs totaling approximately 23,100 acres. The Dismal Hollow SIA became a Resource Natural Area in Amendment 6 of the Current Forest Plan. That reduced the acreage to 22,311 and the number of SIAs to 17. Amendment 5 of the 1986 LRMP proposed new SIAs, and additions to existing SIAs. Criteria were developed to evaluate these proposals. Some of those SIAs are discussed below.

Table 3-158: Special Interest Areas on the OSFNFs.

Special Interest Area	Acres	Special Features
Alum Cove	198	Geologic/Scenic
Blue hole	2,190	Scenic
Buzzard Roost	62	Geologic/Scenic
City Rock Bluff	370	Geologic/Scenic
Clifty Canyon	5,486	Botanical
Devils Canyon	1,827	Botanical
Dismal Creek	245	Botanical
Hare Mountain	88	Scenic
Magazine Mountain	5,999	Scenic
North Twin	2,335	Scenic
Pedestal Rocks	520	Geologic/Scenic
Penhook	390	Scenic
Sam's Throne	630	Geologic/Scenic
Sandstone Hollow	512	Geologic/Scenic
Stack Rocks	339	Geologic/Scenic
White Rock	713	Geologic/Scenic
Waldo/Wainscott	407	Botanical
Total GIS Acres	22,311	

***Note the acreage figures are GIS acres.**

Geologic SIAs on the OSFNFs feature very unique rock outcrops, bluffs, and overhangs. Some of them such as Pedestal Rocks have spectacular panoramic views. Many have developed recreation sites associated with them such as Alum Cove, White Rock, or Pedestal Rocks. Sam's Throne is a very popular rock climbing area. Other SIAs are very undeveloped and inaccessible.

Botanical SIAs contain unique plant species that occur in very few areas on the Forests. Because of the unique plants species, these SIAs are not developed. Public use is allowed, but is more of a dispersed recreation opportunity.

Scenic SIAs do not necessarily have spectacular geologic features, but offer exceptional scenic views. Mt. Magazine is the highest point in Arkansas. This SIA is managed under a special use permit with the state of Arkansas, and is a major destination area.

New Special Interest Areas

The following four new SIAs were inventoried as possible additions to some of the alternatives. Eagles Gap was recommended in Amendment 5. The other three are new SIAs that met the inventory criteria for SIAs used during the inventory stage of plan revision.

Devils Eyebrow – Boston Mountain Ranger District

This 364-acre proposed SIA is in very rough terrain with unique botanical, geologic, and scenic qualities sometimes described by locals as "the land that time forgot."

Jacks Creek - Boston Mountain Ranger District

This 1,894-acre proposed SIA is in very rough terrain with unique botanical, geologic, and scenic qualities.

Fern Gulley - Boston Mountain Ranger District

This 306-acre proposed SIA is in a very steep and narrow canyon with unique botanical, zoological, geologic, and scenic qualities. It is well known for rock climbing, repelling, bouldering, and "flash flood kayaking." One natural formation resembles a wheelchair accessibility ramp from the top of the bluff to the floor of the canyon.

Eagles Gap – Buffalo Ranger District

This 225-acre proposed SIA is in a steep and narrow canyon in the winding tributaries of the Kings River. It has unique botanical and scenic qualities. This SIA is part of what was a proposed 2,000-acre new proposed SIA in Forest Plan Amendment 5. The OSFNFs entered into an agreement with the Natural Heritage Commission to determine its unique qualities by following a set of criteria outlined for SIA determination. The Natural Heritage Commission recommended the 225 acres.

Scenic Byways

Driving for pleasure has always been one of the top ten recreational activities on national forests. The OSFNFs have six scenic byways, five on the Ozark NF and one on the St. Francis NF. The scenic byways encompass approximately 27,456 acres of the OSFNFs These scenic byways were designated in the early-to-mid 1990s, and are traveled by thousands of visitors each year. Of the six scenic byways, one is a national scenic byway, one has state and forest service designation, and four are strictly forest service scenic byways. The major difference is the availability of funding opportunities for national scenic byways. In addition, the state legislature must approve state scenic byways.

Traditionally there has been very little timber management along most of the byways. The visual management system (VMS) designated the immediate foreground with a "retention" rating, which allows for very little vegetation management other then salvage operations. Many of the timber stands are fairly old. The red oak borer has severely impacted the oak forests along some of the byways such as State Highways 7 and 21. Table 3-159 shows the existing scenic byways:

Table 3-159: The Existing Scenic Byways on the OSFNFs.

Scenic Byway	Highway	Miles	Designation
Mt. Magazine Scenic Byway	309	21	**Forest Service**
Ozark Highlands Byway	21	35	Forest Service
Pig Trail Byway	23	19	Forest Service
Scenic 7 Byway	7	61	State/Forest Service
St. Francis Scenic Byway	44	21	National
Sylamore Creek Scenic Byway	5 and 14	27	Forest Service

Following is a description of each of the scenic byways on the OSFNFs:

Mt. Magazine Scenic Byway. This byway includes approximately 21 miles of Highway 309 south of Paris to Havana in Logan County. It takes visitors across the top of Magazine Mountain SIA, the highest point in Arkansas, and Mt. Magazine State Park, owned by the Forest Service, but managed under special use permit by the State. The byway passes Cove Lake Recreation Area and the Cove Lake Trail. Panoramic views are spectacular from the top of the mountain. Vegetation is mostly pine and mixed pine/hardwood forests traveling up to the top of the mountain; then, the vegetation is very open and glade like.

Ozark Highlands Byway. This byway includes approximately 35 miles of Highway 21. It begins north of Clarksville in Johnson County, and travels north to the Upper Buffalo Wilderness and Buffalo National River in Newton County. This byway is a highlands route, crossing ridges between the headwaters of major streams. Traveling the byway from south to north is the historic Ozone Recreation Area and a trailhead for access to the Ozark Highlands Trail. The Mulberry, Big Piney, and Buffalo Rivers

are accessed from this road and provide many canoe launching sites. Vegetation is mostly pine and mixed pine/hardwood forests.

Pig Trail Scenic Byway. This byway includes approximately 19 miles of Highway 23 between the towns of Ozark and Brashears. The Pig Trail is a major route to the Northwest Arkansas cities of Fayetteville, Springdale, Rogers, and Bentonville. This route provides access to well-known locations such as Eureka Springs, Beaver Lake, and Table Rock Lake. The Pig Trail is a very popular route for travelers going to Arkansas Razorback games in Fayetteville. Vegetation is mostly pine and mixed pine/hardwood forests.

Scenic 7 Byway. This byway includes approximately 61 miles of Highway 7 that connects Louisiana to Missouri through Arkansas. It crosses two forests, a national park, a national scenic river, and several state parks. Thirty-seven miles are on the Ozark NF. It crosses the Piedmont area of Arkansas through the Ouachita Mountains, and then drops into the Arkansas River Valley near Russellville before once more climbing into the Ozark Highlands. North of Russellville is the newly renovated Rotary Ann Rest Area. It then goes into the town of Jasper where it crosses the Buffalo National Scenic River. Vegetation is mostly pine forest on the south end, and then hardwood forests north of Rotary Ann.

St. Francis Scenic Byway. This byway includes approximately 21 miles of the designated Great River Road, a national scenic byway, located on the St. Francis NF. The byway is located between the cities of Helena/West Helena and Marianna. It passes Bear Creek and Storm Creek lakes and the Mississippi and St. Francis River valleys. Bear Creek and Storm Creek lakes are now known as the Mississippi River State Park, owned by the Forest Service, but managed under special use permit by the state of Arkansas.

Sylamore Scenic Byway. This byway includes approximately 27 miles of Highways 5 and 14, and Forest Service Road 1110. The route goes through a park-like portion of the Ozark NF, which leads visitors to the nationally recognized Blanchard Springs Caverns. The byway links Mountain View to the south and the mountain community of Calico Rock to the North. Vegetation is mostly pine and mixed pine/hardwood forests.

New Scenic Byways

The three additional scenic byways total approximately 74 miles. These byways include: Highway 123 from Pelsor to Hagarville; Mulberry River Road, including highways 215 and 103; and the Sylamore Scenic Byway Extension.

Experimental Forests

Experimental Forests (EFs) are authorized by Congress and have been designated by the chiefs of the Forest Service over the last 90 years. The national network of EFs provides much of the scientific basis for the management of forest ecosystems, including public and private lands. Almost all EFs are located on national forests. EFs on the OSFNFs are managed by the Southern Research Station (SRS). These lands

help provide the current and future research needs of the SRS and demonstrate common forestry practices to non-industrial private forest landowners.

The OSFNFs have two experimental forests: the 720-acre Henry Koen EF, designated in 1950; and the 4,200-acre Sylamore EF, designated in 1934. Both of these are administered by SRS.

Henry Koen Experimental Forest. This 720-acre experimental forest is located on the south bank of the Buffalo River near Jasper, Arkansas. The Koen EF was established in 1950 to develop scientific principles for forest management. The site was named for Henry R. Koen, once the forest supervisor of the Ozark NF, whose conservation career lasted four decades in the first half of 1900s. Seven 4- to 24-acre watershed basins (hardwood stands) were instrumented to monitor precipitation, air temperature, barometric pressure, stream flow, and sediment. Although stream flow gauging flumes remain in place, no active hydrology research has occurred on the site since 1979. The vegetation is mainly an oak-hickory upland hardwood forest.

Sylamore Experimental Forest. Located in Stone County near the community of Mountain View, Arkansas, the Sylamore EF was the site of many early research projects pertaining to the management of upland hardwood forests. The Sylamore EF consists of approximately 4,292 acres and is surrounded by forest service roads. The area is dominated by oak-hickory stands interspersed with pine. The EF has a number of intermittent streams, and was the location of numerous wildlife studies, notably two 1-square-mile pens for deer studies. The vegetation in most of the area is mature upland hardwoods stands dominated by oaks. Some areas, especially the south facing slopes, have a significant component of shortleaf pine.

Direct and Indirect Effects

Special Interest Areas

The 17 existing SIAs and proposed new SIAs total approximately 23,243 acres, about 2 percent of the Ozark NF. A comparison of SIA acres by alternative is in Table 3-160. No existing SIAs are recommended for deletion in any alternative. Some have had boundary adjustments for better management. This is represented in Table 3-160. Alternative A represents current management.

Table 3-160: Acres of Special Areas by Alternative.

Special Interest Areas	Alternatives				
	A	B	C	D	E
Acres of Special Interest Areas					
Existing SIAs	22,311	22,311	22,311	22,311	22,311
Boundary Adjustments			-1,857		-1,857
New SIAs			2789		2789
Total SIA Acres	22,311	22,311	23,243	22,311	23,243

All alternatives contain the existing SIAs; under Management Area 1.G. Alternatives C and E include existing SIAs, boundary adjustments, and the new SIAs. Alternatives A, B, and D represent no change from the existing plan. These alternatives have no new SIAs and no boundary adjustments. The unique characters of the new SIAs would remain unrecognized by the public. The areas would lack special protection from normal management activities and generally lack management designed to enhance the unique characteristics of SIAs. Future designation could be precluded by resource development activities such as road building or natural events such as fire or flood. The new SIAs would be under other management prescriptions, and would not have the same emphasis as SIAs in Management Area 1.G. The recreation opportunities would be less in those alternatives for those who want to experience interpretation and other unique SIA qualities. No boundary adjustments would make management of the SIAs more difficult; the proposed new boundaries are on existing roads, trails, or other recognizable features. This helps administer those areas more efficiently.

Alternatives C and E would maximize recreational opportunities and experiences. The public would recognize the unique characters of areas all SIAs. The areas would have special protection from other management activities and management would be designed to enhance the unique characteristics of the areas. Boundary adjustments will make management of the SIAs easier. The designation of new special areas could bring increased recreational traffic into these areas. This additional dispersed recreation activity could have negative impacts on some of the botanical 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.

Amendment 5 to the Current Forest Plan proposed other new SIAs and SIA additions. During plan revision, a complete inventory for new SIAs on the OSFNFs was completed using a set of criteria to determine if other SIAs exist, and whether the proposed additions had SIA qualities. From that inventory, Eagles Gap and a proposed 500-acre addition to Pedestal Rocks are reflected in Table 3-160.

Scenic Byways

Alternatives B and E allocate additional acres to Management Area 1.H, Scenic Byway Corridors. These allocations will help the Forests shift toward sightseeing and will increase tourism opportunities. Scenic byway driving is very popular nationwide, and recreationists seek out opportunities to drive scenic byways. This can help small businesses and local economies along the byways. After designation, additional funding specific to scenic byways can help manage both the recreation and vegetation alongside the byways. This can have a positive effect for forest health and tourism values in proximity to the byways.

Alternatives A, C, and D do not propose any additional acres for scenic byways. The effects of these alternatives will not help the Forests shift toward sightseeing or increasing tourism opportunities. Small businesses along the byways and the local economy in general would not see positive benefits. With the lack of designation, additional funding specific to scenic byways would not be available.

Table 3-161 gives the miles of existing and new scenic byways by alternative.

Table 3-161: Miles of Existing and New Byways by Alternative.

Scenic Byways	Alternatives				
	A	B	C	D	E
Miles of Scenic Byways					
Existing Byways	165	165	165	165	165
New Byways		74			74
Total Byway Acres	144	239	144	144	239

Experimental Forests

There are no changes in any alternative for experimental forests.

Cumulative Effects

See the "Recreation" section for cumulative effects for all recreation activities.

HERITAGE RESOURCES

Affected Environment

Human Ecology (relationships involving environment, resources, cultural group size, and social complexity) is the dominant theoretical perspective underlying our understanding of past human culture and history. Regional summaries of this research and derived cultural models are provided in Sabo et al. (1988), and are briefly summarized below. More specifically, Sabo et al. (1982) provide a culture history and archaeological overview for the OSFNFs. This archaeological overview is currently under revision. The GIS Heritage and Ecosystem layers established for the Forests will be used to examine settlement distributions, probabilities of discovery, site preservation, and site destruction by both natural and cultural processes across the landscape.

Climate and Environment

Archaeological, palynological, geomorphological, and climatic records surrounding the Ozark Interior Highlands (Delcourt and Delcourt 1991:24-26) identify four broad-scale climatic episodes. These episodes are pre-Boreal, the pre-Boreal to Boreal transition, the Atlantic or hypsithermal, and the Late Holocene. These paleoenvironmental data indicate substantial shifts in vegetation and human adaptations since the last full glacial episode of the Late Wisconsin. During glacial maximum, the interior highlands were covered by boreal forest with pure stands of spruce (*Picea*) in the northwest and mixed spruce and jack pine (*Pinus banksiana*) to the southeast. Jack pine has serotinous cones and is dependent on stand-replacing fires to maintain dominance in the ecosystem (Parisien et al. 2004), indicating thousands of years of fire in the Ozark Plateau ecosystem during the Pleistocene.

During the pre-Boreal, climatic improvement began approximately 16,500-15,500 YBP (years before present). It appears that distributions of oaks (*Quercus spp*.), hickories (*Carya spp*.), and other modern dominants were highly localized at this time, with an estimated 50 percent canopy cover (Jurney and Stahle 2004:48-49; Jurney et al. 2004). Deciduous forests became more extensive at the pre-Boreal to Boreal transition by 12,000-10,000 YBP with an estimated 40 percent canopy cover. With the advent of the Atlantic from 8,000-4,000 YBP, warm, dry climatic conditions dominated, allowing the spread of prairie and savanna vegetation across the highlands with a severe reduction to 10 percent canopy cover. After 4,000 YBP (late Holocene), many warm temperate plants increased, returning to 40 percent canopy cover, and many of the southern pines (*P. echinata* and *taeda*) became established. Today, the Forests have a mosaic of canopy cover, but most areas are denser than at anytime in the last 4,000 years.

Historical Vegetation

Vegetation derived from analysis of GLO surveys of witness trees from the 1820s-1840s provides a baseline for historical reference conditions. Today, few areas of the Ozarks remain which contain the full range and proportion of plant and animal species that flourished prior to European settlement. For archaeologists and land managers, there is a need to develop statistically sound models of past ecosystems over entire landscapes to understand vegetation potential and historical changes in vegetation (Warren 1984, Warren and O'Brien 1984, Foti and Glenn 1991, Foti 2004). Also, as stressed in USFS *Region 8 Directives for Watershed Assessment* (ecological analysis at the watershed scale), it is important to establish various historical reference conditions to compare with current conditions, with key management plan objectives, and with desired future conditions. It is essential to explain how ecological conditions have changed over time as the result of human influence and natural disturbances.

The OSFNFs are currently compiling a GIS database of all witness trees recorded on the Forests. A stream channel width database is also being compiled. To date, witness trees from the St. Francis and the Main Unit of the Ozark NF have been compiled, consisting of 23,308 witness trees, distributed among 65 "species" identified by common name. For the 1820-1840 period, one true prairie was identified in the St. Francis River floodplain, and true prairies are common in the floodplain and uplands of the Wedington Unit of the Boston Mountain Ranger District (Jurney and Stahle 2004). Two fires were recorded within the Lee Creek Unit and eight "barrens" indicating burned over areas across the Main Unit. Severe natural vegetation impacts include one passenger pigeon roost and 28 tornados.

Based on the distances from land tract corners to witness trees in the GLO data there were 900 corners that fell in relatively open (over 75 links, 49 feet) areas within the forest canopy. It is estimated that at least 3.8 percent of the Forests experienced disturbances to the canopy at any given point in time. Cultural modifications include several hundred miles of roads and 191 fields. The 1820-1840 roads led from the Arkansas valley into the interior highlands following stream channels, with occasional

locations along ridge spines. Agricultural fields were concentrated in floodplains, with rare upland occurrences. Evidence for free-range husbandry was found across the Forests.

Dominant species include white oak (35.4%) and black oak (19.1%). Less frequent co-dominants include hickory (6.7%), post oak (6.6%), pine (5.4%), black gum (5.3%), and red oak (5.1%). Secondary species include beech (1.8%), Spanish oak and dogwood (1.7%, respectively), elm (1.5%), sweet gum (1.3%), chinquapin (1.2%), maple (1%), blackjack oak (0.9%), and ash (0.6%). Incidental species include sassafras and sugar maple (0.3%, respectively); gum, poplar, cherry, ironwood, red elm, and hackberry (0.2%, respectively); black locust and sycamore (0.18%, respectively); walnut (0.15%); black walnut and service (0.1%, respectively); cedar, box elder, and chinquapin oak (0.07%, respectively); hornbeam and mulberry (0.06%, respectively); locust and water oak (0.05%, respectively); and blue ash and cypress (0.04%, respectively).

Rare species include red bud, slippery elm, birch, and cucumber (0.03%, respectively); oak, pawpaw, pin oak, and willow (0.02%, respectively); honey locust and white hickory (0.017%, respectively); and black ash and magnolia (0.013%, respectively). Species with very rare occurrences (0.012%, respectively) include overcup oak, persimmon, willow oak, plum, white ash, black haw, buckeye, china, cottonwood, gum elastic, prickly ash, privey, red haw, and white walnut (butternut).

Tom Foti, with the Arkansas Natural Heritage Commission, is currently examining the GLO witness tree GIS layer for the Ozark NF. This study will examine species occurrence among ecosystems, spatial patterning, canopy closure, and basal area. It will serve as a historical reference guide to evaluate archaeological site distributions, management objectives, and desired future conditions.

Historic Forest Management

There are five critical periods in human use and management of the Ozark forests. The intensity and extent of human uses varies through time, and becomes progressively more intense as human population (Guyette et al. 2002) increases. These critical periods are:

- 12,000 BC-AD 600: Prehistoric Archaic; AD 600-1819: Sedentary
- 1820-1869: Initial Developed Agriculture
- 1870-1934: Developed Agriculture to Forest Service Acquisition
- 1935-1972: Initial Forest Service Management
- 1973:-Present

Prehistoric Archaic: <12000 BC-AD 600 Prehistoric. Native Americans practiced two types of land use:

- Archaic hunting and gathering, and
- Sedentary horticulture/agriculture.

During the early part of this period, population density was low and Native Americans practiced a mobile extraction life style based on hunting wild animals and gathering wild foods. Megafauna such as mammoth, mastodon, peccaries, and giant bison were exploited, until they became extinct through climatic change and possible over-exploitation. Following their demise, whitetail deer, bear, bison, elk, passenger pigeon, waterfowl, turkey, and other species were sought during the Holocene. Fire may have been used to drive animals using a group surround method and to increase efficiency during collection of oak and hickory mast (Jurney and Stahle 2004). Bluff shelters were initially occupied during this time and served for shelter and food storage. Land disturbances associated with collection of plant foods may have led to semi-domestication of wild plant foods toward the end of this period (Fritz 1985, 1990, 1994, 1997).

Sabo et al. (2004:32) estimate that an average community of 20 during the early part of this period would require 5 acres of openings for camps per 4.7 square mile catchments across the Forests. A forest-wide population of 7,960 people occupied over 2,000 acres of camps at the beginning of this period. It is difficult to estimate the area covered by fire drives and mast collection. By the end of this period when Native Americans adopted horticulture of native plants, Sabo et al. (2004:32) estimate that an average community of 250 would require 62.5 acres of garden space per 4.7 square mile catchments across the Forest. A forest-wide population of 99,734 people farmed over 25,000 acres of gardens at this time.

For many thousands of years, human population was low and fire drives along with the natural lightning fire regime were the principal alteration of the landscape. The combined lighting fire frequency for the OSFNFs, as determined from fire records, ranges between 6 to 18 lightning fires/million acres/year, with peaks during droughts (Jurney and Stahle 2004). Species composition and forest density were reflective of climatic conditions during the early part of this period. Fire use intensified through group surround hunting, mast collection, and the establishment of genetic isolation by geography necessary to domesticate a suite of wild plants.

Prehistoric Sedentary: AD 600-1819. Around AD 600, populations had significantly increased (Guyette et al. 2002) and a suite of domestic plants was introduced from Mexico; corns, beans, and squash; supplemented with native and semi-domesticated wild plants and animals. The bow and arrow replaced the throwing spear, and hunting strategies changed from group-surround to isolated stalking. Sedentary villages, cemeteries, and camps were established. Bluff shelters were used for occupation and storage, with occasional use as cemeteries. Extensive areas of floodplain forest were cleared for villages, fields, and mound centers. Generally, the forest was maintained at a low level of management with fire used to alter specific habitats and increase game, to allow nut collecting (Hilliard 1986), to regenerate

fallow fields, and to make areas habitable. One tree species, bois d'arc (Maclura pomifera), sought for it importance as bow wood, appears to have been transplanted outside its native range into the Ozarks by the Caddo and Osage tribes (Jurney 1994). Nucleated villages with large amounts of clay-tempered pottery, stone digging tools (Jurney 1981), and burial mounds are characteristic of the period. Populations were expanding and intensive manipulation of the environment is evident. The societies are thought to have become larger and more complex with a growing need for community organization and social regulation. Sabo et al. (2004:32) estimate that an average community of 400 during this period would require 125 acres of garden space per 4.7 square mile catchments across the Forest. A population of 159,200 people forest-wide at this time farmed over 376,000 acres of gardens.

- Around A.D. 600, tropical cultigens were introduced leading to intensive agriculture. Large earthen mounds were constructed (mainly floodplains, some uplands) and extensive areas were stripped of arboreal vegetation around these ceremonial and civic centers. Both species composition and forest density began to change due to this progressive increase in human land use. From 1747-1764, the mean fire return interval (FRI) determined by dendrochronology of fire-scarred trees is 1 to 3 years with a mean FRI of 2.43 years (Guyette and Spetich 2003, Jurney and Stahle 2004:49).

Initial Developed Agriculture: 1820-1869. European exploration and translocation of southeastern Indians through Arkansas Territory occurred during the late 18th and early 19th centuries. Many tribal groups immigrated to Arkansas Territory. European settlement was negligible until the 1820s, when most Native American treaty rights were extinguished in the Ozarks. GLO surveys of the public domain were conducted from 1817-1845 in the OSFNFs. The St. Francis NF contains one of the two initial baselines for the entire Arkansas surveys. These surveys provide the first systematic reference condition data on the composition of native plant communities of the period, and include natural disturbances such as tornados, fires, and passenger pigeon roosts (Lockhart et al 1995). Some squatters were noted at this time, and land clearing, cultivation of fields, and introduction of free-range husbandry increased as public land was granted to settlers. This trend intensified until halted by the Civil War in the 1860s. The forest ecosystem received the first severe impacts at this time, particularly land clearing and overgrazing by cattle and hogs. Many native grasses (bunch grasses, canebrakes, etc.) were severely reduced in range at this time.

- European settlement increased in 1820, and commercial sale of public domain prompted land clearing for farmsteads soon thereafter. Settlement impacts increased to a peak at the time of the Civil War. Selective cutting of white and post oak was needed for constructing log houses. Commercial cutting of dimension lumber for frame houses from shortleaf pines was limited to small commercial enterprises. More intensive and extensive changes were produced in species composition and forest density. From 1804-1906, the mean FRI determined by dendrochronology of fire-scarred trees is 1 to 9 years with a mean FRI of 4.4 years (Guyette and Spetich 2003, Jurney and Stahle 2004:49).

Developed Agriculture to Forest Service Acquisition: 1870-1934. Around 1870, the introduction of the railroad, river traffic, and improved overland transportation allowed expansion of small farmers throughout the Ozarks; and the rise of farm tenancy in the Mississippi Delta. From 1890-1910, small subsistence farms increased, but life was marginal for many. The vast passenger pigeon flocks along with bear, deer, and wild turkey disappeared. Land lost for failing to pay taxes increased, and land holdings were concentrated into fewer hands as land speculation increased. Commercial enterprises such as tie mills, stave mills, turpentining, mineral extraction, and fire wood collecting increased the cleared lands across the forest. A public awareness grew that forest reserves were being rapidly depleted. From 1906-1909 the last extensive virgin forest in Arkansas was cut, and small farmers moved onto cutover and remaining tracts and tried to raise crops on land with thin topsoil and rough terrain (Strausberg and Hough 1997). Cattle and hogs were left to wander free-range through the woods. As with the timber companies, when one place played out the farmers/herders simply moved to a new one. Some worked farms as tenants of large landholders/speculators, and frequently moved in the hopes of finding better living conditions. During off seasons, subsistence farmers worked in small portable mills where white oak was cut for staves, ploughs, handles, lumber, and fence posts; and pine was cut for lumber and tapped for turpentine extraction.

In 1908, these worn out farms and cut over timberlands were set aside as the Arkansas National Forest. From 1908-1934, the USFS acquired lands from bankrupt timber companies as well as small farmers and land speculators. Initially forest management focused on fire suppression and replanting cutover areas. Tract acquisition files often provide inventories of each parcel, listing the type and sizes of trees as well as cultivated areas, roads, and former house locations. Forest structure and composition were radically altered during this period by removal of mature shortleaf pine and white oak stands. Exotic herbaceous species were introduced and arboreal species such as red cedar rapidly colonized outside their previous range. The historic archaeological data provide a minimum estimate of 9,452 farmsteads on the OSFNFs that were occupied between 1890-1940. Using 110 acres as a mean farm size with 43 acres under cultivation (Schalm 1973:59-63) 1,039,720 acres (92%) of the forest could have been occupied or used for resource extraction between the late 19th and early 20th centuries. Of this, 406,436 acres (36%) were cleared and cultivated by a population of 172,218 people; and the remaining 64% were used as wooded pasture (Jurney and Stahle 2004).

- From 1870-1934, the full impacts of the Industrial Revolution reached the OSFNFs. Agriculture spread from floodplains to uplands, and only less attractive land was available in the Public Domain. Railroads and overland roads tied hinterland areas to urban markets, and everyone began to participate in a consumer economy. Extensive clearing of virgin pine and white oak forests occurred. The latter end of this period marked the peak landscape fragmentation and produced the most extensive changes to species composition and tree density. From 1916-2004, the mean FRI determined by dendrochronology of fire-scarred trees is 12-62 years with a mean FRI ranging from 5.3-22 years (Guyette and Spetich 2003, Jurney and Stahle 2004:49).

Initial Forest Service Management: 1935-1972. From 1935-1972, the USFS continued fire suppression, attacking all wildland fires. Some timber management began, with the establishment of sawmills and cut over areas in the forest by the mid-1960s. In the 1939 Grazing Management Plan for the Ozark National Forest, 2,581 grazing permittees ran 40,038 head of livestock on the Forest. This yields an average of one grazer/428 acres and one head of livestock/27.6 acres grazed on the Ozark NF. All grazers signed agreements to not set fire to improve range. At this time, the first preserved systematic records of fires began to be kept. Fire District Atlases record the vegetation of the period; fire locations and causes; areas of slash from logging operations; and the viewscapes associated with fire towers. FRIs became greater, understories became denser, and overstories became overstocked. The chinquapin suffered from an introduced disease, and was virtually eliminated from the overstory and understory of the Forest.

- From 1935-1972, the USFS, reversing to an extent the previous fragmentation of the landscape, acquired former farmsteads and railroad and timber cutover lands. Key transportation routes were improved, reducing erosion and sediment load in streams. Fire suppression created up to a 20-times (20x) increase in the FRI (Guyette et al. 2002, Guyette and Spetich 2003), leading to dominance of fire-intolerant species, and increasing the forest density (Foti 2004). The Civilian Conservation Corps (CCC) and USFS actively replanted many old fields and cutover lands in pines and hardwoods. Species composition and stand density was managed on federal lands with extensive replanting, but this was not the case on many private lands. Loblolly pine was an introduced species. If not replanted in pines, old fields regenerated in red cedar and walnut among other species. Based on historical USFS fire records (1916-2004), lightning fires ranged from 6-18/million acres/year, and human-caused wildfires ranged from 87-114/million acres/year.

1973-present. From 1973-present, the modern practices employed by the USFS became established. Fire suppression and tree stocking density continue to create problems with forest health. Prescribed fire was introduced at the end of this period, but does not reach the frequency that has been captured by fire-scarred trees that lived through the preceding 300 years.

- From 1973-present, all federal management of the forests was challenged in court cases. Today some practices are mandated by judicial decree, and interdisciplinary teams considering the ecological impacts of planned activities review all activities. Prescribed burning was initiated in the 1990s, as the full effects of fire suppression became known in forest health. Forests are 2 to 4 times denser than the 1820-1840 GLO historical reference conditions. Removal of trees is now tied to our understanding of stand structure and density rather than production of commercial lumber.

Archaeological Resources

The OSFNFs have completed intensive archaeological surveys and consultation on 304,314 acres (26.2%) of the Forests. This yielded 3,911 total sites dominated by Historic (79.1%), Prehistoric (14.3%), and Both Components (6.6%). Twenty-one sites are listed on the National Register, 46 have been determined eligible, and 72 historic cemeteries are protected as if they were eligible for the National Register. No Traditional Cultural Properties have been identified, but some ancestral sites of native Caddos, immigrant Osages, and immigrant Shawnees have been identified, and may be used by living communities in the future. Only 443 sites (11.3%) have been determined not eligible for the National Register, leaving 3,329 sites (85.1%) of undetermined eligibility. As required by National Historic Preservation Act (NHPA), these undetermined sites must be protected and managed as if they were listed on the National Register.

Archaeological surveys have identified 1,472 prehistoric sites. The largest single category is undifferentiated prehistoric lithic (stone) scatters (73.6%), followed by undifferentiated Archaic (9%), Woodland (5%), Mississippian (3.7%), and Late Archaic (3.5%). Few sites represent all other categories. The significance of these data is that the majority (14.5%) of the identified cultural components date to the Archaic (1500 YBP+). This indicates a relatively low intensity human occupation and use of the Ozarks throughout most of prehistory. The Mississippian, Woodland, and Kent phase categories (11.1%) represent sedentary populations. Sedentary groups are marked by semi-permanent villages, mound building, and the earliest known agricultural practices.

Archaeological surveys have identified 2,439 historic sites. Table 3-162 illustrates the categories (with percentages) of these sites. The significance of these data is that the majority of the identified historic cultural components date to the Developed Settlement era of the late 19th and 20th centuries (ca. 1890-1940). This indicates a tremendous increase in human impacts to the landscape that is tied to population growth and improved transportation (see Guyette et al. 2002).

Table 3-162: Categories and Percentages of Historic Sites on the OSFNFs.

Categories of Historic Sites	Percentages
Developed Settlement-Rural Agriculture	73.9
Pioneer Settlement-Agriculture	9.1
Developed Settlement	7.6
Developed Settlement-Rural Nonagricultural	3.5
Anglo-American	1.8
Developed Settlement-City/Town	1.7
All Other Categories	2.4

Inventory surveys are continuing on the OSFNFs on a project-by-project basis; with inventory surveys tied to ecosystem management treatments. On average, about 15,000 acres are inventoried each year. Based on the past rate of intensive survey

and appropriate funding through project requests, total inventory of the OSFNFs will be completed by 2040; with the exception of wilderness areas where inventory surveys are not funded. Some sites possess attributes that clearly indicate their importance to history, and can be determined eligible for the National Register of Historic Places. However, evaluation of significance is a costly endeavor, requiring substantial excavation, and analysis, and must be planned within budgetary constraints. Eventually the categorization of all sites will be completed as

- Class I, National Register eligible or listed;
- Class II, undetermined; and
- Class III, not eligible.

When possible, partnerships such as the Passport In Time may be used to conduct evaluations.

Direct and Indirect Effects

All planned projects receive review and, if necessary, inventories are conducted prior to any land disturbing activities. The OSFNFs have completed intensive archaeological surveys and consultation with Arkansas SHPO and Native American Tribes on 304,314 acres (26.2% of the Forests). This yielded 3,911 total sites, dominated by historic (79.1%), prehistoric (14.3%), and both components (6.6%). Twenty-one sites are listed on the National Register, 46 have been determined eligible, and 72 historic cemeteries are protected as if they were eligible for the National Register. Listed properties include CCC developed recreation areas and Native American rock art sites. Only 443 sites (11.3%) have been determined not eligible for the National Register, leaving 3,329 sites (85.1%) of undetermined eligibility. As required by NHPA, these undetermined sites must be protected and managed as if they were listed on the National Register. Inventory surveys are continuing on a project-by-project basis. Based on the past rate of intensive survey and funding, total inventory of the OSFNFs may be completed by 2040. It is projected that when inventory is complete, the OSFNFs will have documented 14,940 archeological sites.

If direct effects to significant cultural resources cannot be avoided, data recovery through consultation may be used to mitigate the impacts. Indirect affects could include soil erosion and compaction of historic properties due to visitor use, and access given to locals could result in archeological site vandalism.

Based on the types of activities planned within each alternative, and the associated acreages of each, the alternatives are ranked according to potentially greatest impacts. It is stressed that inventory, avoidance, protection, and data recovery treatments are programmatically applied to all ground-disturbing projects.

Alternative D has the highest potential for ground-disturbing impacts to heritage resources. Alternative C has the second highest potential impacts to heritage resources. Alternative A has the third highest potential impacts to heritage resources. Alternative B has the fourth highest potential impacts to heritage resources.

Alternative E has the least potential impacts to heritage resources. However, since heritage inventories are funded by projects, Alternative E provides the least resources for inventorying, evaluating, and protecting heritage sites, cemeteries, and sacred sites across the Forests.

Cumulative Effects

Natural processes are unavoidably degenerating archaeological deposits through time. Forms of green mitigation may handle erosion, where revegetation with native grasses minimizes tree growth (USDI, Technical Brief 8 1992). Tree removal may be used to reduce fuel accumulation around rock art sites, and minimize root penetration and mass wasting from tree throws on open air sites. All land management activities are reviewed prior to implementation for potential disturbance to significant resources. Many management activities do not alter significant properties beyond the natural or cultural impacts they have already received. However, cumulatively, the repeated implementation of all project activities could result in the degradation of historic or prehistoric properties, unless these cumulative actions are considered in management treatments. This is the primary reason that the avoidance option is commonly used. However, avoidance in some cases (where vegetation is uncontrolled and results in overstocked, undesirable, or decadent growth conditions that could damage significant heritage resources) may result in benign neglect (where vegetation is uncontrolled and results in overstocked, undesirable, or decadent growth conditions that could damage significant heritage resources).

Repeated installation of fire lines is done in existing disturbed conditions, or by using natural firebreaks, if feasible. Prescribed burns can be used to cost effectively control damaging vegetation growth on historic ruins and cemeteries, if hand lines or foam/foil are used to reduce heat effects. Similarly, the increased installation and expansion of recreation facilities, particularly OHV trails, could result in the increased degradation of sites and a reduction in the number of intact historic properties as a result of continued use, increased public access, erosion, and vandalism.

Cumulatively, historic properties could be degraded, destroyed, or subjected to increased site vandalism with continuation of special use permits, increases in and the expansion of mineral extraction sites, the creation of new roads, and expansion and renewal of wildlife plots and pond construction.

SCENERY MANAGEMENT

Affected Environment

Largely due to the mountainous terrain, about 77 percent of the 1.2 million acres of the OSFNFs can be seen from adjacent or interior roads, trails, or waterways. The other 23 percent is considered seldom seen or areas only seen by those who use low standard roads and travel routes, such as hunters and hikers. The more scenic landscapes - those allocated as Preservation, Retention and Partial Retention in the Visual Management System (VMS) or as Very High, High, or Moderate in the Scenic

Management System (SMS) - are generally associated with or occur adjacent to lakes, rivers, streams, designated wilderness, national recreation trails, or highly developed recreation areas. Elevations in OSFNFs range from the highest point in Arkansas (Mt. Magazine at just over 2,750 feet) to elevations of less than 200 feet along the Mississippi River. Views beyond the immediate foreground are influenced by terrain as well as vegetation type and density. The steep to rolling ridges and valleys characterizing the Forests are covered with an almost-continuous canopy of soft- to medium-textured rounded tree forms, creating a natural-appearing landscape character.

Since the late 1990s, because of the red oak borer infestation that killed large numbers of red oaks, part of the canopy has opened. Groups of tall, gray, defoliated stems, varying in size from less than an acre to more than 100 acres, eventually give way to an emerging deciduous and evergreen understory. This process has been speeded by active salvage operations in areas where human health and safety is critical.

The vast majority of the Forests (> 1,064,800 acres) are characterized as **"Natural Appearing."**

"Designated Wilderness Lands" (66,223 acres) dominated by ecological processes are characteristically natural evolving landscapes.

"Rural-Forested" is a very small category that includes the Forests' most highly developed recreation areas.

"Rural-Pastoral/Agricultural" is an equally limited category composed mainly of some managed open areas (such as managed pastures) intermingled with private lands, which influence forestlands.

The OSFNFs are located within the Eastern Broadleaf Forest (Continental), and the Lower Mississippi Riverine Forest Physiographic Provinces. The Eastern Broadleaf Physiographic Province portions of the Forest lie in three ecological sections as described by Bailey and others (1994) and are described as follows:

- **Ozark Highlands Section.** This area lies in the northern districts of the Ozark NF, including the Wedington Unit, Koen Experimental Forest, and the Sylamore Ranger District. This ecological section has a highly diverse mix of irregular plains and high, tree covered hills with entrenched valleys and steep slopes. The 12 ecological subsections making up this area range from 10 percent to 95 percent forested. Natural forest patterns are contrasted with agricultural patterns such as fences and pastures. Water features include large reservoirs, spring-fed streams, lakes, and ponds that contrast with the continuous canopy of soft-textured, rounded tree forms, creating a near natural appearing landscape character. Vegetation varies from little bluestem grass plains to shortleaf pine stands to oak and hickory forest. Oak-hickory is

the principal forest type throughout most of the forested area of this section. The viewer perceives a primarily natural landscape mixed with farmlands, croplands, pastures, and rural developments.

- **Arkansas Valley Section.** This area includes the Magazine Ranger District and the southern part of the Bayou Ranger District. This area is made up of plains with low, tree-covered hills and isolated mountains reaching nearly 3,000 feet. This section is a mix of natural forest, agricultural lands, and urban areas. Geometric patterns due to pastures, croplands, roads, and other human influences dominate these lands. The three subsections making up this ecological section range from only 20 percent forested in the western Arkansas Valley Mountains to 77percent forested in the western Arkansas Valley Mountains. The primary landscape feature is the Arkansas River and its major tributaries. Stream courses, power line corridors, pasturelands, and highway corridors throughout the valley break the tree canopy. In many areas, rock bluffs are visible from travel routes. The vegetation is primarily a mixture of shortleaf pine stands and occasional loblolly pine plantations (both mainly in the western Arkansas Valley Mountains) and oak-hickory forests

- **Boston Mountains Section.** This area includes the northern sections of the Boston Mountains, Pleasant Hill, Buffalo, and Bayou Ranger Districts. This ecological section is made up of broad rounded ridges, benches or terraces, bluff tops, and rugged mountains with sharply defined narrow valleys. Most of the area appears as a natural forested landscape with little evidence of human development other than roads, pastures, and small towns. The tree canopy is broken only slightly by stream courses and rock bluffs. Subsections range from 65 percent to 85 percent forested. Vegetation density prevents most views beyond the immediate foreground. Occasional pine forests formed on abandoned homesteads where pastures regenerated naturally into pine break extensive hardwood stands. Pine forests are found in slightly greater concentrations in the southern part of the Lower Boston Mountains subsection. Rural areas and agricultural lands occur mainly in the valley bottoms and on benches within this area, but are not as common as in other ecological sections of the Highlands.

The St. Francis NF is in the Mississippi Alluvial Basin Section and is described as follows:

- **Mississippi Alluvial Basin Section.** This area includes the St. Francis NF. This ecological section includes Crowley's Ridge, an isolated low ridge ranging from 300-500 feet in elevation. The ridge is covered with hardwood forests. The remainder is bottomland flat plains ranging from 0-300 feet in elevation and covered with bottomland hardwood forests. This isolated ridge (bordered by the Mississippi River to the east and flat agricultural lands to the west) creates a stark contrast to the surrounding area. Several small lakes occur in this area and some small streams, but the primary water features are the St. Francis and Mississippi Rivers.

Existing Visual Quality

The scenic resources of OSFNFs are currently managed in accordance with the 1986 LRMP, as amended. Scenic resource management direction in the 1986 Forest Plan is through Visual Quality Objectives (VQOs), determined by the Visual Management System (VMS). The 1986 LRMP summarized the acres assigned to Visual Quality Objectives as follows in Table 3-163.

Table 3-163: Visual Quality Objectives (1986 LRMP).

Visual Quality Objectives	Acreage	Percent of Land Base
Preservation	67,200	06%
Retention	111,400	10%
Partial Retention	289,500	25%
Modification	553,400	49%
Maximum Modification	118,000	10%
Total	1,139,500	100%

The scenic resource has been re-inventoried to comply with the Scenic Management System (SMS), which replaced the VMS in 1995.

See *Landscape Aesthetics, A Handbook for Scenery Management, Agricultural Handbook Number 701* for description of the SMS system and crosswalk between the SMS-SIOs (Scenic Integrity Objectives) and the VMS-VQOs (Visual Quality Objectives). National forest lands have been inventoried to identify scenic classes from Level 1 (highest level) to Level 6. The crosswalk between Visual Quality Objectives (Visual Management System) and Scenic Integrity Objectives (the updated Scenery Management System) is illustrated in Table 3-164.

Table 3-164: Crosswalk Between Visual Management System and Scenic Integrity Objectives (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 (M)	Low (L)
Maximum Modification (MM)	Very Low (VL)

Special Places

Special Places are those specific locations and expanses in outdoor settings that have attractions and features that are identified as unique, different, distinctive, and extraordinary to people. Special places are not part of the special areas.

A comprehensive inventory of constituents' special places has not been conducted. However, drawing from places listed with high concern levels in the Forests' Scenery Inventory and constituents' comments to project analyses; areas such as wild and scenic rivers, scenic byways, developed recreation sites, and scenic overlooks can be considered special places.

Most of the sites enumerated above fall within boundaries of designed wilderness, developed recreation areas, officially designated scenic areas, areas established as thematic cultural landscapes, rural historic districts, or administrative sites. Some fall within corridors of scenic byways, rivers, or nationally designated trails. As such, each of these falls within areas with established visual management objectives (Scenic Integrity Objectives) by management area.

Direct and Indirect Effects

The scenic resource would potentially be affected by management activities altering the appearance of what would be seen in the landscape. Short-term scenic effects that result from management activities 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 that result in visual alterations inconsistent with the assigned Scenic Integrity Objective (SIO) affect scenery, even with mitigation.

Management activities that have the greatest potential of affecting scenery would be road construction, vegetation management, insect and disease control, special use utility rights-of-ways, and mineral extraction. Other management activities that also would potentially affect 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, and administrative site facility construction, and wildlife management. Table 3-165 describes the acreage allocations to various SIOs by alternative.

Table 3-165: Scenery Integrity Objectives (SIOs), by Alternative.

SIO	Current Plan	Alternatives				
		A	B	C	D	E
Very High	66,200	66,200	66,200	66,672	66,200	66,200
High	111,400	770,774	388,931	641,795	381,135	543,649
Moderate	289,500	289,500	413,053	188,854	417,728	275,178
Low	553,400	231,453	277,935	248,797	281,057	260,620
Very Low	117,900	0	0	0	0	0

In all alternatives, there is little to no change in the landscape character themes of natural appearing and natural evolving.

Existing designated wilderness consistently would be allocated to a "very high" SIO in all alternatives. In all alternatives, all scenic byways, recommended byways, wild and

scenic rivers and recommended rivers, research natural areas, and the Ozark Highlands Trail Corridor would potentially receive a "high" SIO (unless they occurred in areas that received an SIO of "very high").

In contrast to the current Plan (the no action alternative), all other alternatives would potentially result in increases in lands assigned "high" and "medium" SIOs. Acreage allocations in "high" SIOs in Alternative A represent 67 percent of all forestlands. Other alternatives range from 33 percent (Alternative D) to 56 percent (Alternatives B, C, and E).

Alternatives A, C, and E reflect the highest percentage of allocation to "high" and "medium" SIOs. Alternatives B and D would reflect a small percentage at 34 percent and 33 percent, respectively. Alternatives that receive the highest acreage to "high" and "medium" SIOs would result in more protection and enhancement to the scenic resources than alternatives having fewer acres assigned to the higher SIOs. However, those alternatives with more acres assigned to SIOs of "high" would provide a greater amount of protection and enhancement. In descending order, these are Alternatives A, C, E, B, and D. All alternatives have a relatively low number of acres assigned to "low" SIO (20 to 25%) compared to the current Plan.

Negative impacts to scenery from road construction, vegetation management, insect and disease control, special use utility ROWs, and other activities would be the greatest in Alternative B. The current Plan alternative includes an SIO of "very low" on 10 percent of the total forest acreage, and a combined total of 385,036 acres (59%) in "low" and "very low". "Very low" is no longer a SIO in the updated Scenery Management System. Alternative D would potentially be second with the greatest number of potential negative impacts to scenery, at 25 percent total forestlands assigned to at "low" SIO. Many of these impacts would be avoided by implementing mitigation measures. Impacts would be the lowest in Alternative A because the emphasis is on backcountry recreation and old growth with a decrease in roads and all kinds of vegetation management.

Existing Designated Wilderness (MA 1.A) are lands currently considered naturally evolving. The acreage remains the same across alternatives. Acreage allocations have the potential shift in landscape character to reach the upper ranges of naturally appearing. Alternative C and E would probably shift fewer acres than any of the other alternatives.

All alternatives propose prescribed burning. They range from approximately 70,000 acres annually in Alternative A to a potential of 150,000 acres in Alternative C (see Chapter 2, Issue 4). Drifting smoke, blackened vegetation, and charred tree trunks would be the main negative effects to the scenic resource. Visual contrast to the general forest from fire line construction would also be evident. The contrast levels and duration vary with fire frequency and intensity. Smoke would potentially only last one day, blackened vegetation usually lasts a short time, but charring of trees would potentially be evident for many years. Repetitive burning would potentially reduce overall visual diversity. It would potentially result in loss of valued mid- and understory species such as flowering dogwood, but would potentially promote

herbaceous flowering species. Prescribed fire repeated over time produces stands with open (park-like) understories that allow views farther into the landscape. If all conditions were right during any given year, prescribed burning could occur on approximately 6 percent of the Forests in Alternative A; 7 percent of the Forests in Alternative B; 13 percent of the Forests in Alternative C; 8 percent of the Forests in Alternative D; and 10 percent of the Forests in Alternative E.

Insect infestations and diseases would potentially cause strong, unattractive contrasts in the landscape such as occurred with the recent red oak borer outbreak. Management efforts to control insect infestations and diseases would potentially 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. Each alternative attempts to manage forest health, and help prevent insect and disease outbreaks.

Utility rights-of-way (ROWs) 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 that will have fewer effects on visual resources than alternatives that allow standard leasing stipulations.

Road maintenance affects scenery, especially activities to ROWs. Mowing frequency and timing are factors that would potentially alter the appearance of the landscape. Road construction introduces unnatural visual elements into the landscape and causes contrasts to form, line, color, and texture. Having roads open or closed offers some control over how much of the landscape would be seen, especially the forest interior. Alternatives B, D, and E have the most potential for road construction.

Vegetation management has a great potential to alter the landscape and impact the scenic resource. Timber harvest practices would potentially cause long-term effects on scenery. Species conversion, reduction in species diversity, manipulation of the prominent age class, and alteration of opening size, location, and frequency would potentially alter landscape character. The potential effects would be positive or negative, depending on their consistency with the desired future condition of the landscape.

Of the management applications, even-aged management would be the most impacting. Among the even-aged regeneration methods, clearcutting and seed-tree harvest produces 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 landscape character of adjacent areas would have the least impact on scenery. Singletree selection and group selection harvest are normally less evident because they do not cause large openings in the canopy. Uneven-aged regeneration methods would potentially affect scenery, causing contrasts in form, line, color, and texture from slash production. Impacts resulting from timber harvest would potentially be short-term in areas where vegetation growth would be relatively rapid. Vegetation management would be the most prevalent in Alternatives B, D, and E, and least in Alternatives A and C.

Site preparation activities affect scenery by exposing soil and killing other vegetation. These effects are generally short-term on the OSFNFs because of the rapid growth of new vegetation. Site preparation usually improves the appearance of the harvest area by removing the un-merchantable 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. Site preparation would be the most prevalent in Alternatives B, D and E, and least in Alternatives A and C.

Forest-wide mid-story manipulation is a 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 C and E could have the most midstory removal, followed by alternatives A, B, and D.

Recreation facilities are also deviations to the natural landscape that have long-term effects. FS 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. Alternative B and E provide for the greatest recreation development, followed by Alternatives A, C, and D.

Cumulative Effects

See the "Recreation" section for cumulative effects for all recreation activities.

TIMBER MANAGEMENT

Affected Environment

The OSFNFs encompass approximately 1.2 million acres of National Forest System land in Arkansas. The OSFNFs are located within 18 counties primarily across central and northern Arkansas. In these 18 counties, approximately 5,105,156 acres are forested, and 1,380,361 acres are identified as forest service land (this includes portions of the neighboring Ouachita National Forest). Table 3-166 indicates the percentage of forested land and percentage of OSFNFs land in each county.

Table 3-166: Percentages of Forested and USFS Land per County.

County	County Acres	Percent Forested	Percent USFS
Baxter	354,790	79%	18%
Benton	541,433	41%	2%
Conway	355,934	53%	2%
Crawford	381,050	64%	23%
Franklin	390,113	53%	27%
Johnson	423,786	68%	43%
Lee	385,063	21%	3%
Logan	454,318	66%	19%
Madison	535,558	69%	9%
Marion	382,528	64%	1%
Newton	526,698	83%	38%
Phillips	443,306	25%	2%
Pope	519,614	68%	37%
Searcy	426,974	77%	8%
Stone	388,217	89%	16%
Van Buren	455,367	78%	7%
Washington	607,817	52%	4%
Yell	593,848	73%	37%

Source: Arkansas FIA 2002 Data & NRIS 2004 Data

Current Forest Conditions

The OSFNFs are approximately 70 percent hardwood and 30 percent pine dominated forests, the majority of which are older than 70 years old. Table 3-167 indicates the percentage of acres in each forest type represented in the Forests' Continuous Inventory of Stand Conditions (CISC) database. Table 3-168 represents age class distribution for all forested acres that currently have age class data.

Table 3-167: Forest Types in CISC and Associated GIS Calculated Acres and Percentages.

Forest Type	CISC Code	Acres	Percent of Total
Shortleaf Pine/Hardwood	12	34,240	3%
Loblolly Pine	31	10,724	1%
Shortleaf Pine	32	279,134	24%
White Oak/ Black Oak/ Yellow Pine	47	29,323	3%
White Oak/Red Oak/Hickory	53	710,508	62%
White Oak	54	11,845	1%
Forest Types <1%	n/a	32,629	3%
Unknown, Non-Forest	n/a	45,688	4%
Total		1,154,089	100%

Table 3-168: 2004 Age Class Distribution.

Age Class (2004)	Acres
0-19 years	75,790
20-49 years	147,739
50-69 years	50,597
70+ years	804,277

Forest Land Tentatively Suitable For Timber Production

During forestland and resource management planning, the National Forest Management Act (NFMA) requires that the Forest Service identifies lands unsuitable for timber production (16 USC 1604(k); 36 CFR 219.14). This identification is a three-stage process explained in detail in Appendix B, Suitability Analysis. The initial stage (Stage 1) identifies lands tentatively suitable for timber production. Stage 1 lands are either producing or capable of producing crops of industrial wood that

- Have not been withdrawn by Congress, the Secretary of Agriculture, or the Chief;
- Have existing technology and knowledge available to ensure timber production without irreversible damage to soils; and
- Can obtain adequate restocking within five years after final harvest.

Table 3-169 displays lands eliminated in the Stage 1 suitability analysis in order to determine acres tentatively suitable for timber production.

Table 3-169: Stage 1 Suitability Analysis Results.

Classification	Acres
Total Land - OSFNFs	1,161,012
Non-Forest Land	-43,218
Administratively Withdrawn	-91,817
Physically Incapable	-66,526
Technically Restricted	-19,046
Not Adequately Restocked	0
Inadequate Response Information	-283
Tentatively Suitable	940,122

Historical Timber Management on the Ozark-St. Francis National Forests

The OOHA (1999) indicates that the USFS is the area's largest single landholder. Thus, the actions of the region's national forests can sway markets more than any other single landowner. However, the supply behavior of the public sector is exceedingly difficult to predict. Laws, agency policy and regulations, and a management approach that addresses multiple uses as well as ecological conditions govern timber supply for the national forests. The Forest Service timber supply environment is both biologically and economically dynamic and complex.

The USFS uses timber harvests as a means for habitat management and forest health improvements. Forest products are considered a "by-product" of forest management. OOHA indicates that over time the pattern of timber production for the OSFNFs has changed considerably as a result of agency policies. Figure 3-22 displays the OSFNFs timber harvest history from 1910-2003.

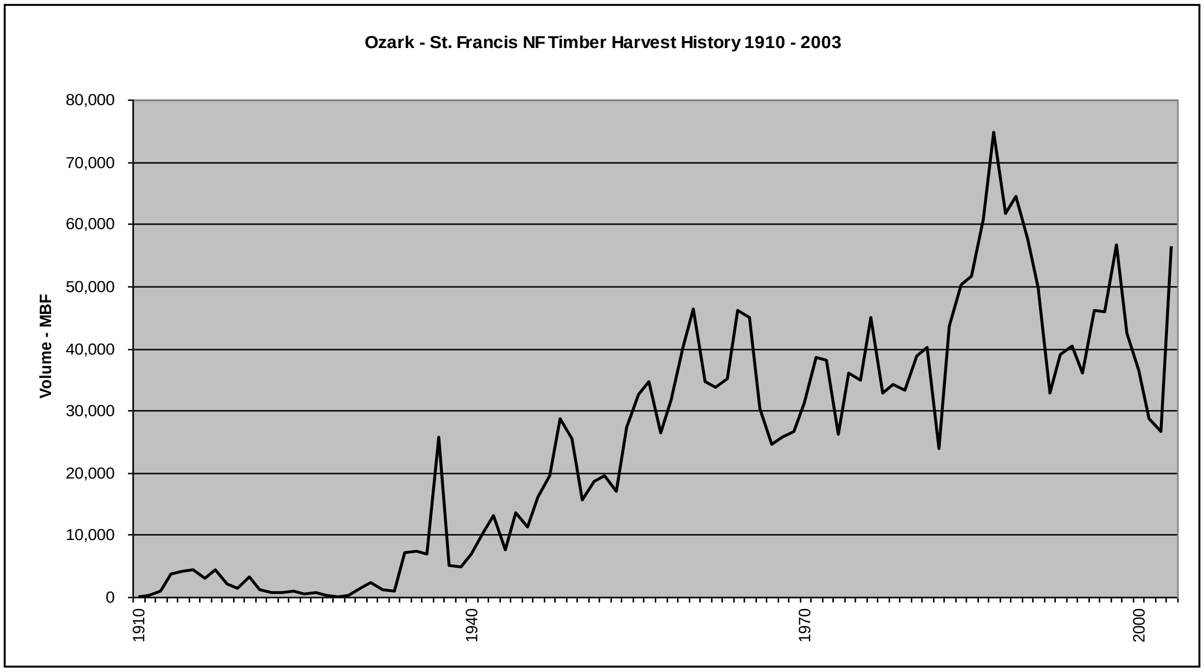

Figure 3-22: Timber Harvest History from 1910 to 2003.

Table 3-170 displays the timber volume sold on the OSFNFs from 1988-2003. Table 3-170 shows that from 1988-2003, the Forests saw a high production of 58 million board feet in 1989 to a low, only two years later, in 1991 of 21 million board feet. During the last three years (2001–2003), the Forests have averaged 51 million board feet in timber sold.

Table 3-170: Timber Sold on OSFNFs in Million Board Feet.

Year	MMBF
1988	54
1989	58
1990	44
1991	22
1992	47
1993	47
1994	37
1995	41
1996	51
1997	45
1998	41
1999	35

Table 3-170: Timber Sold on OSFNFs in Million Board Feet. (Continued)

Year	MMBF
2000	35
2001	41
2002	57
2003	56

Source: OOHA 1999 & M&E Report

Table 3-171 shows the harvest cutting methods by acres utilized from 1986-2003 to implement the objectives of the timber management programs. As Table 3-171 indicates, due to agency policy changes in the late 1980s, there has been a decline in the number of acres clearcut. During the last three years (2001-2003) the Forests have averaged an annual harvest of 6,670 acres.

Table 3-171: Acres by Harvest Cutting Method by Fiscal Year, 1986-2003.

Fiscal Year	Clearcut	Shelterwood	Group Selection	Single-Tree	Thinning	Seed-Tree	Total
	Acres						
Avg. 86'-96'	1,761	377	1,235	684	5,024	676	9,757
1997	52	342	516	623	7,011	1,933	10,477
1998	0	875	1,617	1,743	6,026	1,236	11,497
1999	0	662	889	760	4,784	817	7,912
2000	0	516	152	385	5,974	454	7,481
2001	0	232	626	656	4,647	642	6,830
2002	0	535	173	608	3,676	347	5,339
2003	99	891	100	217	5,502	1,032	7,841

Source: M&E Reports

Forest Service Timber Inventory

Forests are dynamic and respond to environmental and biological factors that influence growth and mortality as well as to people's uses of forest resources. The combined effects ultimately determine timber inventories. In an attempt to examine the net effects of these factors, the OOHA reported changes in forest inventories over the latest inventory cycles. Table 3-172 shows the trend of increased inventory on national forest lands in the Arkansas Ozarks Region. Table 3-173 represents timber volume, growth, and mortality on timberland in the Arkansas Ozarks by ownership category. Of all ownership classes, national forest lands have the highest inventory volumes per acre (OOHA 1999).

Table 3-172: Trends in National Forest Inventory.

Arkansas Ozarks	MMCF	MMBF
Hardwood		
Previous Survey (1988)	1.105	3.108
Recent Survey (1995)	1.218	3.898
Percent Change	10%	25%
Softwood		
Previous Survey (1988)	262	1.177
Recent Survey (1995)	300	1.304
Percent Change	15%	11%

Source: OOHA 1999; 4-194

Table 3-173: Timber Volume, Growth, and Mortality on Timberland in the Arkansas Ozarks by Ownership Category.

Measure	Unit	Ownership Category				Total
		National Forest	Other Public	Forest Industry	NIPF*	
Growing Stock						
Inventory	MMCF	1,518.433	268.912	199.845	4,109.671	6096.86
Inventory/acre	CF/AC	1,613.226	1,208.397	1,149.453	829.069	968.584
Growth/acre/year	CF/AC	42.22	31.672	63.832	25.952	29.633
Mortality/acre/year	CF/AC	6.521	10	2.875	4.21	4.724
Sawtimber						
Inventory	MMBF	5,201.703	931.004	458.865	10,718.699	17,310.272
Inventory/acre	BF/AC	5,526.436	4,183.612	2,639.266	2,162.348	2,750.015
Growth/acre/year	BF/AC	157.346	97.706	1,53.575	81.883	95.707
Mortality/acre/year	BF/AC	19.320	32.839	3.097	10.025	12.03

***Non-industrial Private Forest**
Source: OOHA 1999; 4-191.

Direct and Indirect Effects

All environmental and social effects for the implementation of the following levels of timber management are identified under the appropriate social or resource program headings.

The following quantification displays of early successional habitat, methods of harvest, suitability, allowable sale quantities, timber sale program quantities, and average annual net present values are estimated outputs from the Forests' SPECTRUM model. Please refer to Appendix B for detailed explanation of SPECTRUM development and application.

Suitability

As noted in Table 3-169, the Forests have 940,122 of tentatively suitable acres. The three-stage suitability analysis is discussed in more detail in Appendix B. Table 3-174 shows a summary of the suitable acres for each alternative. Suitable acres vary based on alternative because of the management emphasis and land allocation within alternatives. However, because of the minimal change excepted in land allocation, as displayed below, all alternatives, except B, have approximately 65 percent of the total land base in suitable acres. Note that Alternative B has 337,491 acres in Management Area 0.A (Custodial Management), which is unsuitable for timber production.

Table 3-174: Total Suitable Acres by Alternative.

Lands Classified As Suitable	Alternatives				
	A	B	C	D	E
Acres	760,580	439,185	754,473	760,580	760,580
Percent of Forests	66%	38%	65%	66%	66%

Allowable Sale Quantity

Table 3-175 displays the allowable sale quantity (ASQ) for all products by million board feet (MMBF) and million cubic feet (MMCF) for all alternatives. ASQ is 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 Plan. The quantity is usually expressed on an annual basis as the average "allowable sale quantity." All ASQ figures are based on the constraints of the SPECTRUM Model (for more details see Appendix B). The standard Region 8 conversion of 5.0 board feet per cubic foot was used in all cubic foot to board foot conversions throughout this FEIS. Table 3-176 displays the average annual ASQ for all alternatives for the first five decades.

Table 3-175: Allowable Sale Quantity (ASQ) for the First Decade.

Allowable Sale Quantity	Alternatives				
	A	B	C	D	E
Decade 1					
MMCF	163	133	156	154	146
MMBF	815	665	780	770	730

MMCF – Million Cubic Feet.
MMBF – Million Board Feet.

Table 3-176: Average Annual ASQ by Alternative for the First Five Decades.

Average Annual Volume	Alternatives				
	A	B	C	D	E
Decade 1					
MMCF	16	13	16	15	15
MMBF	81	67	78	77	73
Decade 2					
MMCF	16	13	16	15	15
MMBF	81	67	78	77	73
Decade 3					
MMCF	16	13	16	18	15
MMBF	81	67	78	89	75
Decade 4					
MMCF	16	13	16	18	15
MMBF	81	67	78	89	75
Decade 5					
MMCF	16	13	16	18	16
MMBF	81	67	78	89	80

MMCF – Million Cubic Feet.
MMBF – Million Board Feet.

The SPECTRUM Model also calculates a long-term sustained yield (LTSY) capacity that includes future tree growth in calculating potential long-term yields. Table 3-177 displays the Long-Term Sustained Yield (LTSY) capacity by alternative.

Table 3-177: Long-Term Sustained Yields by Alternative.

Long-Term Sustained Yields	Alternatives				
	A	B	C	D	E
MMCF/Year	16.3	13.3	15.6	19.8	16.1

MMCF – Million Cubic Feet.
MMBF – Million Board Feet.

Forest Products

Tables 3-178 and 3-179 display the estimated annual volume produced in each alternative by market sale group for the first decade. Table 3-178 is in MMCF and Table 3-179 is in MMBF. All of the "considered in detail" alternatives are supportive of vegetation management on varying portions of the land. As a result, as the table suggests, there is a minimal difference in alternatives. Some alternatives have more of a concentrated vegetation management emphasis and, therefore, may theoretically generate products to a smaller geographic area. This may have an effect on local timber markets. However, the USFS contributes only an estimated four percent to the markets within the OSFNFs competitive zone. Alternative D will provide for the most hardwood sawtimber in the first decade and Alternative C will provide for the most pine sawtimber with Alternatives A and E close behind. Alternative C provides for the most pulpwood.

Table 3-178: Estimated Annual Volumes by Product Group in MMCF - First Decade.

Product Groups	Alternatives				
	A	B	C	D	E
MMCF/Year-Decade 1					
All Pulp	5.1	4.7	6.2	4.2	5.3
MHST	2.0	2.3	1.3	2.8	1.4
MOST	<0.1	0.1	0.2	0.1	0.1
PNST	2.9	1.4	4.8	1.7	3.5
ROST	0.1	0.2	0.2	0.5	0.1
WOST	6.9	4.3	3.2	6.1	4.1
Total	16.9	13.1	15.9	15.3	14.6

***All Pulp = all pulpwood; MHST = mixed hardwood sawtimber; MOST = mixed oak sawtimber; PNST = pine sawtimber; ROST = red oak sawtimber; WOST = white oak sawtimber.**

Table 3-179: Estimated Annual Volumes by Product Group in MMBF – First Decade.

Product Groups	Alternatives				
	A	B	C	D	E
MMBF/Year-Decade 1					
All Pulp	25.4	23.6	31.2	20.8	26.4
MHST	10.0	11.6	6.4	13.9	7.1
MOST	<0.1	0.6	0.8	0.6	0.7
PNST	14.4	7.1	23.8	8.6	17.7
ROST	0.3	1.2	1.0	2.3	0.5
WOST	34.3	21.4	16.1	30.5	20.4
Total	84.4	65.5	79.3	76.7	72.8

***All Pulp = all pulpwood; MHST = mixed hardwood sawtimber; MOST = mixed oak sawtimber; PNST = pine sawtimber; ROST = red oak sawtimber; WOST = white oak sawtimber**

Net Revenues

Table 3-180 displays the average annual net revenue values in thousands of dollars for timber management using SPECTRUM costs and revenues and maximizing present net value. Table 3-180 shows how the revenues of the timber harvesting within each decade and each alternative compare to the costs of harvesting timber. Under current laws, some of the "net" amount is available for non-timber renewable resource work (such as wildlife or fish habitat improvements or prescribed burning), while the rest is returned to the U.S. Treasury.

Table 3-180: Annual Net Revenues for First Five Decades in Thousands of Dollars.

Average Net Revenues	Alternatives				
	A	B	C	D	E
Decade 1					
Revenue	$12,000	$8,329	$9,332	$11,122	$9,180
Costs	$10,829	$8,104	$8,768	$10,628	$8,606
Net	$1,171	$225	$564	$495	$574
Decade 2					
Revenue	$12,436	$9,887	$11,128	$10,924	$9,642
Costs	$8,319	$7,342	$7,919	$8,626	$6,926
Net	$4,116	$2,545	$3,209	$2,298	$2,716
Decade 3					
Revenue	$10,353	$8,117	$9,801	$12,538	$9,682
Costs	$8,782	$6,156	$7,729	$9,151	$7,465
Net	$1,572	$1,962	$2,072	$3,387	$2,217
Decade 4					
Revenue	$11,319	$8,657	$10,981	$12,219	$10,661
Costs	$8,628	$7,192	$8,306	$9,186	$7,474
Net	$2,691	$1,465	$2,675	$3,033	$3,187
Decade 5					
Revenue	$11,729	$9,012	$12,058	$12,216	$12,098
Costs	$8,281	$7,208	$8,790	$9,293	$8,439
Net	$3,448	$1,804	$3,268	$2,923	$3,659

In individual timber sale projects, implementing the Revised Forest Plan and site-specific considerations may result in selecting stands, harvests methods, and logging systems that do not result in the highest product values.

Methods of Harvest

Table 3-181 displays the average annual method of timber harvest by alternative for the first five decades. Through the SPECTRUM Model, all alternatives explore the use of a wide range of silviculture prescriptions and timber harvesting methods ranging from clearcutting to no harvest. Such a wide range of choices was evaluated in order to meet a variety of future conditions on a broadly diverse land base. See Appendix B for more details on the development of the SPECTRUM Model and harvesting constraints. It is important to recognize that displaying acres by harvest method is for relative comparison of alternatives only and does not constitute project level decisions. The decision of what harvest method to use will be made at the project level and analyzed and carried out by plan direction.

Table 3-181: Average Annual Harvest by Treatment Type.

Harvest Method	Alternatives				
	A	B	C	D	E
Average Annual Harvest - Decade 1					
Intermediate Harvest					
Thinning	4,252	4,746	8,205	3,500	6,500
Overstory Removal	0	0	0	0	0
Regeneration Harvest					
Uneven-aged	1,000	1,984	1,000	1,000	2,000
Even-aged	9,248	6,270	5,295	10,000	6,000
Average Annual Harvest - Decade 2					
Intermediate Harvest					
Thinning	736	1,588	5,500	1,655	6,000
Overstory Removal	9,202	6,270	5,249	9,369	6,000
Regeneration Harvest					
Uneven-aged	1,000	2,000	239	0	1,000
Even-aged	4,062	3,276	4,012	3,976	2,000
Average Annual Harvest - Decade 3					
Intermediate Harvest					
Thinning	5,682	4,836	6,715	3,500	6,500
Overstory Removal	4,062	3,276	4,011	3,976	1,811
Regeneration Harvest					
Uneven-aged	1,000	2,000	1,000	1,000	2,000
Even-aged	3,756	2,888	3,274	6,024	4,189
Average Annual Harvest - Decade 4					
Intermediate Harvest					
Thinning	4,679	3,536	5,500	4,780	6,000
Overstory Removal	3,755	2,888	3,274	6,024	4,189
Regeneration Harvest					
Uneven-aged	1,000	2,000	239	0	1,000
Even-aged	5,066	4,576	5,487	4,196	3,811
Average Annual Harvest - Decade 5					
Intermediate Harvest					
Thinning	3,876	2,943	6,062	3,500	6,000
Overstory Removal	5,066	3,906	1,924	4,197	1,863
Regeneration Harvest					
Uneven-aged	1,000	2,000	1,000	1,000	2,000
Even-aged	4,558	4,151	5,514	5,803	5,137

Timber Sale Program Quantity

Each alternative has unsuitable lands that do not plan for regular or periodic harvests; therefore, no long-term sustained yield value or allowable sale quantity is calculated. However, they do permit harvest to occur on an irregularly scheduled, case-by-case basis. An example is a developed recreation area in which timber is cut and removed to clear for campground road construction. However, much of it is likely to be salvage resulting from insects, disease, wildfire, or storm damage. Table 3-182 displays the estimated timber sale program quantity (TSPQ) for all alternatives

considered in detail. It includes the ASQ from the suitable land base plus all unplanned volume from unsuitable lands. The TSPQ is expressed as an annual average for the first 10 years of plan implementation.

Table 3-182: Annual Timber Sale Program Quantity Average in Decade 1.

Timber Sale Program Quantity	Alternatives				
	A	B	C	D	E
Annual Average – Decade 1					
MMCF	17.2	14.2	17.2	16.2	16.2
MMBF	86	71	86	81	81

MMCF – Million Cubic Feet.
MMBF – Million Board Feet.

Additional SPECTRUM Analysis

The range of activities within the alternatives chosen for this analysis were intentionally modeled to be reasonable, implementable, practicable, and the most cost effective alternatives [36 CFR 219.12 (f)(8)]. The historical limitations (budgets, personnel, etc.) of the OSFNFs were taken into account. The Forest Plan is written to provide strategic management direction including desired future conditions of vegetation resources on the Forests. When implemented meeting desired future conditions, the Forest Plan is expected to provide for a vegetation resource that provides a continual supply of quality forest products and healthy forest ecosystems, which are defensible to epidemic levels of insects and disease, catastrophic wildfires, and provide optimal wildlife habitat for all species.

The SPECTRUM analysis for each alternative includes constraints and limitations (see Appendix B for more detail) that attempt to apply reasonability to the model. This was done to more effectively model the effects of excepted levels of management over the planning period. One of the many constraints within the model is a total harvest acre constraint. For all alternatives, the maximum acres harvested were limited to 150,000 acres per decade. This is based on historical and future projected budgets. It is unreasonable to accurately project budgets far into the future. Also, it is recognized that limiting the acres of vegetation management on the Forests may not allow managers to accomplish the desired future conditions (as described in the Forest Plan) in the short term. However, since the Plan is strategic, and reaching desired condition is a long-term commitment, the Plan does expect to reach these conditions in the long term.

Additional SPECTRUM analysis was done to look at the general effects of all the alternatives without the harvest limitations included. Some of those results are described below in Table 3-183. Within the limitations of the model (including non-declining flow, long-term sustained yield, perpetual timber harvest, and solving for present net value), these results indicate that in most alternatives slightly more acres could be harvested generating more timber volume and revenues.

Table 3-183: SPECTRUM Analysis.

SPECTRUM Analysis	Alternatives				
	A	B	C	D	E
	ASQ MMCF* – Decade 1				
No Acre Constraint	177	133	154	212	183
With Acre Constraint	163	133	156	154	146
	LTSY** (MCF per Year)				
No Acre Constraint	11,740	13,557	15,430	22,173	18,337
With Acre Constraint	16,292	13,324	15,641	19,780	16,060
	PNV*** (M$) – 5 Decade Average				
No Acre Constraint	28,695	18,381	26,550	28,238	32,107
With Acre Constraint	25,997	16,002	23,576	24,273	18,123
	Acres Harvested – 5 Decade Average				
No Acre Constraint	169,105	106,733	147,599	193,981	168,200
With Acre Constraint	146,000	130,267	147,000	147,000	148,000

***MMCF – Million Cubic Feet. **LTSY - Long-Term Sustained Yield. ***PNV - Present Net Value.**

Cumulative Effects

The trend of increasing urbanization associated with Fayetteville and other metro areas is expected to result in a decline of timberlands in the private sector within both the Ozark and St. Francis National Forests' historic market areas. The decrease in timber supply is expected to increase the importance of national forests as a potential supplier of wood products.

Population growth, associated with the urbanization, shifts political power and changes expectations about the performance of government at all levels. Preferential location adjacent to NF land is usually based on the amenities of visual quality and the recreation opportunities it affords. Neighbors may have a strong preference for a particular type of recreation such as hiking or horseback riding. The area seen from travel ways, homes, and housing developments becomes increasingly sensitive due to both numbers of observers and their level of concern for aesthetics. This trend would indicate increasing conflict, contention, and costs with having timber sales; potentially jeopardizing the ability to meet legal requirements and habitat needs.

The trend of the concentration of older, larger, and higher quality timber on national forests in comparison to other ownerships will continue, maintain, or even increase the desirability of national forest timber. The trend of increasing age of national forest timber will result in an increasing risk to various forest health problems. The widespread red oak borer epidemic, which hit the Ozark NF between 1999 and 2003, has demonstrated to everyone the potential effects of poor forest health. All alternatives are expected to maintain some level of risk to detrimental losses by forest pests and diseases, like the red oak borer. As a result, the amount and quality of timber production by the OSFNFs may be affected.

The OSFNFs' timber sold levels are expected to remain comparable to the 2001-2003 average of 51 MMBF per year. Alternative D is expected to be higher the first decade of the Plan in order to provide for the greatest level of new regeneration and,

therefore, should provide the lowest level of forest health risk. Overall, timber revenues might see a decline in Alternative C and E due to the shift to an ecosystem restoration and wildlife habitat emphasis. Wildlife habitat objectives often are met on lands or with activities producing low product volumes, low product values, or both.

PASTURES AND WILDLIFE OPENINGS

Affected Environment

Habitats considered here include large permanent openings (over five acres), small wildlife openings (five acres and under), and improved pastures. Other early successional habitats such as savannas, woodlands, and early successional forests are discussed elsewhere in this document.

Permanent Openings and Fields

Permanent grass/forb and seedling/sapling/shrub habitats are important elements of early successional habitat. Permanent openings typically are maintained for wildlife habitat on a 1- to 3-year basis with the use of cultivation, mowing, prescribed burning, or other vegetation management treatments. These openings may contain native grasses and forbs, but many are planted to non-native agricultural species such as clover, orchard grass, winter wheat, annual rye, or other small grains. Some openings have residual invasive species such as sericea lespedeza, tall fescue, Bermuda grass, Canada and bull thistle, poison hemlock, or Japanese honeysuckle among others. Most of these openings are less than five acres in size with some scattered larger fields that may range upward to 120 acres.

Permanent openings are used by a variety of wildlife, both game and non-game species. The benefits of permanent openings to whitetail deer are well documented. The availability of high quality forage that can be produced in permanent openings during periods when mast yields are low can help maintain deer populations (Rogers et al. 1990). Maintained openings provide nutritious green forage in the winter and early spring and seeds during late summer and fall. The abundance of these foods along with insects and other invertebrates are some of the reasons that openings have long been recognized as providing an important part of turkey habitat (Hurst and Dickson 1992).

There are numerous benefits to wildlife from openings maintained in native species, such as providing nesting, brood rearing, and roosting habitat for northern bobwhite and other grassland wildlife species. Native species are well adapted to local environments and generally require less intensive maintenance following establishment.

Forest plan direction has been to establish at least four 1- to 5-acre wildlife openings in the absence of glades, closed roads or utility corridors, per 640-acre habitat unit. This density of openings has been obtained in some of the active vegetation management areas but not in others.

There are approximately 7,072 acres of permanent maintained openings and fields on the OSFNFs. This represents .06 percent of the total national forest OSFNFs' acres. Most of the large opening fields have come under FS management through land acquisition and are now managed for wildlife benefits and/or to maintain a pastoral visual setting. Many of these acres are funded and maintained through FS partnerships with the Arkansas Game and Fish Commission (AGFC), the National Wild Turkey Federation (NWTF), Quail Unlimited (QU), and others.

Rangelands

Livestock grazing has a long history in this area. Much of the rougher upland areas were settled between the 1880s and 1930s. These settlers made wide use of open range for cattle and hogs (OOHA 1999). Grazing permits have been issued on the Forests since the early 1920s; however, most of the livestock grazed in trespass. It is estimated that as late as 1965 there were more than 8,000 head of cattle and 6,000 hogs illegally grazing on the Forests in addition to the 1,500 head that were grazing legally (Bass 1981).

In 1966, the Forests began aggressive management to trap and remove illegal hogs and set carrying capacities for cattle. In the intervening years, open range has changed more to the use of fenced, improved pastures. Overall, rangeland use has slowly declined as land-use patterns have changed and people have modified their way of life away from the early settler lifestyle.

Although pastureland acreage has been significantly reduced over the last 50 years, pastures still comprise approximately seven percent of the southeastern United States (USDA Forest Service 2001). About five percent of the acres grazed on the Ozark-Ouachita Highlands occur on FS lands with the bulk of them on private land (OOHA 1999).

Forest wide, a downward trend in the number of range permittees and livestock has occurred since 1978 when there were 231 permittees with approximately 6,400 cattle grazing FS lands. That number dropped quickly and in 1982 there were 164 permittees on FS lands with approximately 4,100 cattle. Currently, there are fewer than 35 permittees with 1,300 head of cattle, or a reduction of 79 percent in the number of permit holders and 68 percent in the number of cattle permitted to graze (OSFNFs FEIS, LRMP 1986). While the demand for improved pastures has remained relatively high, woodland range use has diminished quite a bit (OOHA 1999).

Currently rangelands include approximately 3,485 acres of improved pastures and another 13,198 acres that are managed in woodland range allotments. The Boston Mountain and Sylamore Ranger Districts along with the St. Francis National Forest have most of the improved pasture acreage. The Buffalo and Magazine Ranger Districts have smaller amounts while the Bayou and Pleasant Hill Ranger Districts have no range allotments. The grazing of cattle has been used to help maintain these lands in an open grassland or grass/forb/shrub stage and to preserve the open, pastoral setting on selected portions of the Forests. Specifically, these areas are not

only managed to provide forage for livestock and aid the local economy but also provide a variety of recreational opportunities such as maintaining scenic views.

Livestock grazing is managed through a site-specific allotment management plan and environmental assessment supported by a thorough analysis of the range situation as directed by Section 2200 of the Forest Service Manual and pertinent handbooks. All grazing use is by permit only and yearlong permits are discouraged. Term Grazing Permits are preferred over other permit types because of their stronger controls, management flexibility, and fee credit availability.

Grazing of livestock on national forest land requires the development of a variety of range improvements and livestock control measures. These include structures such as fences, water developments, corrals, gates, and cattleguards. The Forest Service typically constructs most of these improvements. The grazing permittee annually maintains the improvements to FS standards. Many of these structures, especially fences, have exceeded their useful lifespan, and are in dire need of reconstruction. Table 3-184 shows the total grazing land acreage by type and district as well as the grazing capacity animal unit months (AUMs).

Table 3-184: Total Grazing Land Acreage by Type/District/Grazing Capacity AUMs.

Ranger Districts	Improved Pastures	Woodland Allotment Acres	Grazing Capacity Animal Unit Months (AUMs)
Sylamore	474	0	1,572
Buffalo	45	9,008	252
Bayou	0	0	0
Pleasant Hill	0	0	0
Boston Mountain	2,605	3,140	5,066
Magazine	5	105	445
St. Francis NF	356	0	2,355
Total	3,485	12,253	9,690

Forage production appears good on most improved pastures and livestock numbers are managed as necessary to meet the carrying capacity and provide for wildlife needs. Woodland allotments provide only limited forage capability and stocking is adjusted to account for this factor. The benefits of better forage capability by grazing livestock on improved pastures in addition to conflicting resource needs have lessened the necessity to continue woodland grazing. With the attrition of older range permittees, woodland range allotments are being phased out over time.

Pastures, although maintained to provide for cattle, also provide wildlife benefits. Wild turkey may utilize pastures for "strutting grounds, nesting sties and appropriate brood habitat" (Dickson 2004).

The conversion of fescue pastures to native warm season grasses improves habitat for numerous wildlife species including turkey, quail, and small mammals like mice and voles. These plantings help concentrate insects, which are an important food source

for these species. They also provide valuable nesting cover as well as insulation from the winter cold (Missouri Conservation Commission 1980).

Featured sites for warm season grasses are primarily old farms that were in cultivation when acquired by the Forest Service. Native warm season grass plantings have been established on several pastures or parts of pastures on the Boston Mountain Ranger District. Emphasized species include big and little bluestems, Indian grass, and switchgrass.

Occasionally, there may be impacts to pastures as the result of insect depredation. In 2002, an infestation of armyworms occurred on the Boston Mountain Ranger District heavily impacting five range allotments. Approximately 400 acres of pasture required revegetation. Once the infestation had been treated, these acres were limed, fertilized, and reseeded restoring them to production.

Management Indicators

Management indicators for large wildlife openings and pastures are:

- Total acres in pasture measured annually,
- Total acres of pasture in native vegetation measured annually,
- Total pasture AUMs of grazing measured annually,
- Acres of large wildlife openings constructed annually and
- Acres of large wildlife openings maintained annually.

Small wildlife openings are features found in most management areas across the Forests. The following management indicators will be used to monitor their management:

- Acres of small wildlife openings constructed annually, and
- Acres of small wildlife openings maintained annually.

Direct and Indirect Effects

Permanent Openings and Fields

Large wildlife openings and pastures are not predicted to change from current in Alternatives A, C, and D. In Alternatives B and E, the Wildlife Emphasis Management Area (3.K) is added. This is predicted to add an additional 500 acres of large wildlife openings within that management area. Net effect in Alternatives B and E would be to improve wildlife habitat in the area and specifically provide new home range for the Buffalo River Elk Herd. Detrimental effects on other wildlife species such as interior bird species is thought to be minimal since the bulk of this management area will be in woodland and forest condition.

All alternatives would maintain open areas that are in place. New open areas that are acquired would be evaluated as to future management, but it is expected that most would be managed as native vegetation wildlife openings.

Direction in all proposed alternatives for plan revision is to provide four 1- to 5- acre openings per section (640 acres) in the absence of glades, sufficient woodland condition, day-lighted roads, utility corridors, or non fescue openings on adjacent private lands. This is applied to active management areas.

Permanent wildlife openings and fields will be maintained under all alternatives although different emphasis of each alternative will alter the amount of new openings that may be constructed. Alternatives such as C and E that provide more open areas by managing larger amounts of woodland condition would result in fewer constructed and maintained small wildlife openings. Alternatives A, B, and C would result in more small wildlife openings.

The continuation of providing small wildlife openings will provide positive benefits to a variety of wildlife species and have little adverse effect on other wildlife species.

Rangeland

Existing improved pastures will continue to be maintained in all alternatives with woodland range allotments being phased out as attrition occurs. Although there is no deterrent to new improved pastures being incorporated into the forest range system, it is more likely that in the future some of the existing improved pastures will be dropped from the system as older permittees retire and demand diminishes. Where this occurs, these units will revert to field status and be managed along with existing openings and fields.

Cumulative Effects

Permanent openings are a very important habitat element for a variety of wildlife species including both game and non-game species. However, they comprise a very small (< 1%) percentage of the landscape of the OSFNFs. The habitat conditions provided in these permanent openings are very different from those provided by lawns, ball fields, and improved fescue pastures that are more common on adjacent private land. Generally, the openings on private land are not maintained in the grass-clover or native warm season grass mixtures available in FS openings. Therefore, most of the openings on private land do not provide comparable benefits to wildlife or for hunting or wildlife viewing opportunities. In addition, the FS does not have control of the management of the openings on private land. Areas that currently provide habitat may be developed in the future and, therefore, cannot be relied upon to provide long-term wildlife benefits. It is important to maximize the benefits from this limited acreage on the Forests by maintaining these openings in high quality habitat conditions. Other open-land habitats such as some types of improved pastures are found on private land. Because of the abundance of these habitats on private land, management of these habitats is not a major focus of national forest management.

In areas where there is extensive maintenance of open lands on near by private property there is little that can be done to change overall habitat conditions. For this reason there are no cumulative effects expected with opening management on National Forest lands.

FIRE MANAGEMENT

Affected Environment

Wildland and Prescribed Fire

Fire Management on the OSFNFs encompasses a wide variety of activities including wildfire prevention efforts; wildfire suppression; hazardous fuel reduction (prescribed burning and mechanical treatments); ecosystem management involving the restoration, maintenance, and enhancement of fire-adapted ecological communities; firefighter training; community assistance in dealing with wildfires; and the dispatching of firefighting resources to both fire and non-fire (or all risk) incidents.

The Fire Management organizational functions on the OSFNFs are combined with those on the Ouachita National Forest. Overall program oversight is divided between administrative, operational, logistical and planning sections with staff personnel at both supervisor's offices and an interagency coordination center located in Hot Springs, Arkansas. During the fire season, the Forests also operate a tanker base and two helibases (refer to the Process File for a complete overview of the fire program on the OSFNFs).

Historical Overview

Numerous researchers have made attempts to describe the pre-settlement landscape of the Ozarks. There are also many accounts by early explorers and adventurers that document how vegetation appeared at the time of their journeys (OOHA, Rpt 2 1999).

Researchers who have studied GLO records and fire scarring (dendrochronology) in Arkansas and Missouri offered findings at the recent Upland Oak Ecology Symposium in Fayetteville, Arkansas. There is a general consensus among scientists that the pre-settlement forest structure and fire regime in the Interior Highlands was probably much different than today's. Descriptions of the pre-settlement forest, on dry sites especially, indicate forests were most often open woodlands with widely spaced trees, grassy or herbaceous ground cover, and a distinct "park-like" appearance. There were also savannas and glades with only a few scattered trees. Some of the landscape was a prairie. Much of the landscape was dominated by fire-adapted vegetation where periodic, low-intensity fire (both lightning–caused and aboriginal) maintained ecological conditions that guaranteed a dynamically changing, yet stable perpetuation of regional flora and fauna.

Undoubtedly, there were also some closed canopy forests, particularly on more mesic sites. The slope, aspect, elevation, soils, and an aboriginals-induced fire regime largely dictated these diverse conditions. Currently, tree densities in the Ozark Highlands are likely two to three times more dense than those of the 19th century. Surveyor's notes from the early 1800s mention fire-associated features on the landscape (glades, meadows, and other openings) as indications of a short fire-return interval and part of the natural fire regime. Mean fire return intervals in the late 1700s were estimated at 2.43 years in the lower Atoka Hills adjacent to the Arkansas River. In nearby Missouri, mean fire return interval from 1705-1830 was 7.6 years. Other recent studies have concluded a mean fire return interval of 11.2 years prior to 1820 for the lower Boston Mountains. These relatively short mean fire return intervals aided both oak and pine to dominate landscapes and were ecologically stable and sustainable. Current mean fire return intervals are 80+ years. Most ecologists believe that current pine and oak ecosystems are threatened because of the long absence of fire.

The compositional, structural, and functional components of the pre-settlement forest have been estimated and interpreted by ecologists. The life histories of various tree species and other life forms and their relative response to fire can help explain how the frequency, intensity, and seasonality of fire in the pre-settlement forest may have contributed to the overall functioning of the ecosystem. There are many examples of fire-adaptations of tree species occurring in the Ozarks. The list of species adapted to fire that appears to thrive in fire-dominated habitats includes faunal species now extinct or extirpated. The plant lists are equally diverse including not only tree species, but also grasses, wildflowers, and other woody and herbaceous plants.

Lightning-caused fires versus Native American Burning

Ecologists are now largely in agreement about the relative "naturalness" of past aboriginal burning. Simply stated, Native Americans were a part of the natural ecosystems. The disturbance processes they initiated, or contributed to, were integral to the development of stable ecosystems. The significance of aboriginal burning hinges on the low likelihood of lightning-caused fire giving rise to extensive landscapes dominated by fire-adapted vegetation. While lightning certainly may have played a role in fire occurrence in the Ozarks, its importance appears to be minor as compared to the estimated effect of Native American burning.

In pine and oak ecosystems of the Interior Highlands, natural fire regimes were once relatively frequent and mostly low-intensity fire. The relative departure of a current forest condition from an estimated pre-settlement era condition or "reference condition" determines condition class and can be used to prioritize where fuels mitigation work is needed today. The reference condition is considered as the landscape where ecosystem function involving natural patterns and processes resulted in the most sustainable and self-perpetuating conditions for ecological communities. Such forests are often more resilient and resistant to alteration from either natural or man-caused disturbances. Condition class, therefore, has a direct implication on the relative health of an ecosystem.

Wildland Fire Suppression

Fires generally fall into one of three categories: wildland fires, prescribed burns, or escaped fires. A wildland fire is a fire resulting from an unplanned ignition; it requires an appropriate management response to control its spread. A prescribed fire is any fire ignited by management actions to meet specific objectives. An escaped fire is a prescribed fire that exceeds its prescription or a wildland fire that exceeds the initial level of control actions and requires re-evaluation through a Wildland Fire Situation Analysis.

The further fire-adapted forests depart from the reference condition the higher the likelihood of catastrophic fire. There have been several drought years documented when devastating wildfires have occurred in Arkansas. These fires have brought with them the loss of property and life. They have served as stand replacement events in ecosystems less ecologically adapted to such disturbances.

Each year Arkansas experiences hundreds of wildfires. Many of these fires threaten rural homes and other structures. Federal, state, and local rural fire departments are primarily responsible for controlling these wildfires.

Firefighting forces suppress most wildfires in Arkansas while they are small. These fires often occur at times of the year and under conditions so that fire intensities are low or moderate resulting in little damage. Without prompt suppression, however, many of these fires would grow in size and eventually threaten homes and property. Some fires occur on "high fire danger" days where low relative humidity and wind result in larger, more potentially destructive wildfires. These are most often springtime events. Although infrequent, when summer and fall droughts occur, wildfires in Arkansas can be very destructive.

The largest recorded fire in recent times to occur on USFS lands in Arkansas was the Eagleton Burn near Mena, Arkansas, in October 1963. This blaze raged for 4 days and burned over 13,000 acres. In 1963, it was the largest wildfire in the United States. 1971 was a major fire year with three wildfires on USFS lands over 1,000 acres in size. 1980 was another extremely dry year that saw an unusually high number of wildfires in the state (over 6,000 fires statewide for a total twice the normal). Again in 2000, Arkansas experienced a prolonged drought that helped to create conditions conducive to large fires. The most notable of these was a blaze on Petit Jean Mountain State Park that burned over 1,400 acres and received state and national media attention.

On USFS lands in the State (Ouachita, Ozark, and St. Francis National Forests), a total of 111 wildfires greater than 100 acres in size have occurred since 1970. In 1995, the Lick Hollow Fire on the Ozark-St. Francis charred 2,770 acres.

Table 3-185 illustrates statistical causes of wildland fire occurrence on the OSFNFs during the period from 1980-2003. Seven percent of the wildfires were caused by lightning, while the other 93 percent were caused by humans. Of the human caused fires, 60 percent were arson with the other 33 percent being accidental causes of ignition.

Because human-caused fires are the largest percentage of wildland fire occurrence, being able to apply prescribed fire helps keep litter and brush buildup in check. Prescribed fire helps to reduce the potential that human-caused fires will be destructive when they occur. A difference in fire intensity and tree damage or mortality is usually noted when human-caused fires occur in areas untreated with prescribed fire as compared to areas that have been treated with prescribed fire. The difference in fire intensity relates to how easy or hard it is to suppress a wildland fire and what dangers firefighters have to encounter. Increased fire intensity means an increased potential that fire will move from the surface to the crowns of the forest canopy.

There were 55 large fires from 1980-2003, ranging from 100 acres to 2,770 acres. The largest wildland fire, at 2,770 acres, was an arson fire that burned along the Oklahoma state line for several days before making a run toward the Lee Creek Unit on the Boston Mountain Ranger District. This wildland fire occurred in March 1995. A large fire is any wildland fire that grows to over 100 acres before it is contained.

Table 3-185: Ozark-St. Francis National Forests' Fire Occurrence Statistics 1980 – 2003.

Cause	Year											Totals
	1980-1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Lightning	88	5	4	4	2	3	4	5	3	2	5	125
Equipment	37	2	0	2	0	2	1	2	1	2	1	50
Smoking	39	2	5	2	1	1	3	2	1	0	0	56
Campfire	40	5	2	4	5	2	2	1	4	3	4	72
Debris Burning	80	12	7	18	4	5	4	6	3	1	2	142
Arson	643	61	92	58	48	36	48	30	22	33	13	1,084
Children	3	2	0	0	1	0	0	0	0	0	0	6
Misc.	138	11	16	12	15	13	20	6	2	10	20	263
Total Fires	1,068	100	126	100	76	62	82	52	36	51	45	1,798
Total Acres	16,839	789	4,551	2,482	626	419	122	101	176	954	557	29,631

Hazardous Fuel Reduction

Fire management to promote public safety is integrated as a part of the hazardous fuel mitigation program to lower the risk of catastrophic fire through the direct reduction of fuel loading and modification of fuel profiles. Typical fuel loads across the Forests range from 5 to 15 tons per acre with fuel types 2, 8, and 9 predominating. In areas of severe oak mortality or in damaged stands (e.g., tornadoes, ice storms) fuel loads are often twice the normal or average condition. Prescribed burning usually removes 2 to 3 tons per acre.

Priorities for hazardous fuel reduction are based on whether:

- Land are in the wildland urban interface (WUI) - including federally designated "communities at risk" and/or,
- The need to do ecosystem restoration in fire-adapted ecosystems (generally when fire has been excluded for 20 years or more), or
- The need to further improve or maintain areas where restoration work has already been done.

Fire Regime and Condition Class Definitions

A concern for Forest Health and its relationship to the risk of catastrophic fire to the public has resulted in a number of government-wide initiatives including the National Fire Plan (NFP), The Healthy Forest Initiative (HFI) and Healthy Forest Restoration Act (HFRA). These initiatives recognize the natural role of fire in ecosystems and the problems decades of fire exclusion in these ecosystems have created in relationship to hazardous fuel build-ups and the risk of catastrophic fire. Fire ecology research has resulted in the classification of ecosystems based on fire regime and condition classes (FRCC). Assessments of FRCC can help managers determine where fuels mitigation activities and ecosystem management work is most needed. Prescribed fire is integral in restoring fire-adapted ecological communities and in lowering wildfire risks to people living in the wildland urban interface/intermix areas.

Fire regimes are based on fire severity. Most of the OSFNFs are in Fire Regime 1 and characterized as naturally having frequent (< 35 year MFI) periodic fires of low to mixed severity intensity. Mesic sites and the St. Francis NF in eastern Arkansas are mostly Fire Regime 3, characterized by longer fire return intervals (> 35 years) and mixed severity.

Fire condition classes are used to characterize both general wildland fire risk and ecosystem condition. The following are the three fire condition classes:

Condition Class 1 is characterized by: (a) fire regimes within or near a historical range, (b) low risk of losing key ecosystem components, (c) departure from historical frequencies by no more than one return interval, and (d) intact and functioning vegetation attributes (species composition and structure) within an historical range.

Condition Class 2 is characterized by: (a) fire regimes moderately altered from their historical range, (b) moderate risk of losing key ecosystem components, (c) departure (either increased or decreased) from historical frequencies by more than one return interval, and (d) moderate alteration from the historical range of vegetation attributes.

Condition Class 3 is characterized by: (a) fire regimes significantly altered from their historical range, (b) high risk of losing key ecosystem components, (c) departure from historical frequencies by multiple return intervals, and (d) significant alteration from the historical range of vegetation attributes.

Current conditions on the OSFNFs in the regional assessment of FRCC are displayed in Table 3-186. The assessment was based on analysis of the FY 2000 Continuous Inventory of Stand Conditions (CISC) database.

The following Table summarizes findings for the National Forests in Arkansas and Oklahoma.

Table 3-186: Fire Regime and Condition Classes on the OSFNFs.

Class	Acres
1	4,466
2	151,892
3	950,524
5	39,639
Total	1,146,521

Based on the Region 8 Mid-Scale Assessment, 950, 524 acres of the OSFNFs are in the worst possible of condition classes (Condition Class 3). 151,892 acres are in Condition Class 2 and only 4,466 acres are estimated to be in Condition Class 1.

Prescribed Burning

The rationale for prescribed burning varies and can include ecological restoration, fuels management, silvicultural, wildlife habitat improvement, control of non-native invasive species, or other objectives. A prescribed burn often meets multiple objectives. Prescribed burning is also done on the national forests to help meet specific game and non-game wildlife habitat objectives, to facilitate silvicultural operations, and to aid in the control of non-native invasive vegetation.

All prescribed burns require the completion and approval of a prescribed burning plan. These plans clearly state the objective(s) of the burn, document compliance to regional weather parameters, and identify prescribed conditions needed to accomplish objectives (e.g., fuel moisture, wind direction, speed, relative humidity, mixing heights, transport winds, drought index). Smoke screening is done to identify potential smoke-sensitive targets and is done up to 100 miles from planned burns. An emission model, fire behavior model, and smoke dispersion model are run prior to burning to ensure compliance with all state and federal standards and predict fire intensity in response to specific burn objectives. A complexity analysis is done for burns where special integration/coordination is required. Specific mitigation (public notification, need for

smoke warning signs, or other needed coordination) is documented. Weather is monitored periodically throughout the day of the burn. Other monitoring is conducted before, during, and after burns for implementation, effectiveness, and validation monitoring. Table 3-187 shows the prescribed burning statistics for the OSFNFs from 1999-2003.

Table 3-187: Prescribed Burning Statistics for the OSFNFs from 1999 to 2003.

Year	Prescribed Fire Acres Accomplished
1999	26,421
2000	30,162
2001	28,011
2002	38,337
2003	76,557

Source: Ozark/St. Francis Monitoring and Evaluation Reports 2001 – 2003.

Smoke Management

All woods fires produce smoke. Smoke from prescribed burning is a problem when it creates an annoyance or nuisance, and when it negatively affects human health and safety. Ideally, personnel planning the prescribed burn should be able to predict smoke production and movement before they ignite a fire. Currently, however, there is no smoke dispersion model developed specifically for the complex terrain found in the southeastern United States. As a result, estimates of smoke movement are based on "straight-line" mapped trajectories with a 15-degree variation to allow for possible wind shifts and idealized dispersion. Even the best of weather forecasting is not perfect and occasionally there are differences between the predicted weather and what actually occurs. Worst-case scenarios and contingencies are pre-planned and documented in burning plans on all complex burns. Emissions' modeling is not an exact science either, and is influenced by weather factors. Problems most often occur when either predicted wind direction, mixing heights, or transport winds do not match the actual conditions during a burn. Lower or higher than expected relative humidity can affect fire behavior and lead to either not meeting burn objectives or making the burn more difficult to complete in a timely manner.

Because of the potentially serious effects of prescribed fire on air quality and prescribed fires inherent value in ecosystem management, guidelines have been developed by the Forest Service and state agencies to reduce the atmospheric impacts of prescribed fire. These guidelines include:

- Plotting the trajectory of the smoke on all planned burns.
- Identifying smoke-sensitive areas such as highways, airports, hospitals, etc.
- Identifying critical targets close to the burn or those that already have an air pollution problem.
- Determining the fuel type to be burned.
- Minimizing risk by burning under atmospheric conditions that hasten smoke dispersion, or by using appropriate ignition patterns to reduce pollution.

Burning under proper weather conditions can reduce the impact of smoke. Fire managers are required to have the most current weather forecasts with enough information to predict fire and smoke behavior.

Safety and Snags

Recent oak mortality has created large areas with unusually high numbers of dead trees (snags) that pose hazardous working conditions for firefighters and forest visitors. Inventory plots reveal that there are now 29,779 acres with high (or severe) oak mortality. These areas have an average of 39.1 snags per acre over 9 inches in diameter and, of this total, 15.8 snags over 14 inches in diameter. In areas moderately impacted by oak mortality (98,900 acres), areas average 20 snags per acre with approximately one-half of these over 14 inches in diameter. These averages are four to eight times the normal for total number of snags when compared to unaffected oak stands. In unaffected stands only about 1 snag per acre is over 14 inches in diameter. These conditions are unprecedented and have serious implications in regard to firefighting tactics, safety, and fire behavior.

Wildland Urban Interface

The wildland-urban interface (WUI) is becoming more of an issue as the populations grow and private lands within the forest boundaries are becoming populated with single structures, small farms, poultry operations, and other developments. Many rural residents typically like to live in wooded surroundings and desire to maintain a natural vegetative setting around structures, which blends their property into the adjacent forested environment. While being aesthetically pleasing, an unmanaged forest setting on private land or on federal land adjacent to private structures can become a hazardous fuel issue in the event of a wildfire. Nationally, the direction is to increase hazardous fuel treatment either with prescribed fire or mechanical treatments in WUI areas. These areas pose the greatest threat to public and firefighter safety as well as being the most complex and expensive areas to suppress wildland fires. A variety of methodologies were assessed to provide an estimate of WUI on the Forests

Communities at Risk

State and federal land managers for the states of Arkansas and Oklahoma developed a list of "Communities At Risk". This list was published in the Federal Register (Federal Register 66:751 2001). Between the two states, over 500 communities were listed. A GIS analysis was used to help identify how many of these were within one-half mile (0.5 mi) of national forest lands. Of the "Communities at Risk" on the OSFNFs, there are about 794 acres of federal land within the half-mile boundary. The communities that fall within this parameter are displayed in Table 3-188.

Table 3-188: Communities at Risk on OSFNFs.

Communities Within ½ Mile Of National Forest Lands
Blue Mountain
Cass
Deer
Limestone
Lurton
Natural Dam
Oark
Ozone
St. Paul

The breakdown of condition class on federal land in relation to "Communities at Risk" is shown in Table 3-189.

Table 3-189: Acres by Condition Class within 0.5 Mile of Communities at Risk.

Condition Class	Acres
Condition Class 3	617
Condition Class 2	119
Condition Class 1	58
Private Land	3,004
Total Acres	3,798

Direct and Indirect Effects

Fire Suppression/WUI/Communities at Risk

There would be no differences between any of the alternatives in wildfire suppression activities (the control of wildfires). All alternatives deal with escaped fire the same way. All the alternatives would address the management of hazardous fuels in the wildland urban interface and aggressively implement practices to move these areas into Condition Class 1. The effects on "Communities At Risk" are not expected to vary among alternatives.

Fire Regime and Condition Class (FRCC)

While none of the alternatives are likely to affect more than 15 to 20 percent of the Forests (lowering condition class), Alternatives C, D, and E have the greatest potential to lower condition class on the greatest acreage. Alternative C would most effectively accomplish the changing of condition class. With current budgets, staffing, and smoke management concerns, it could take up to 15 years to successfully and effectively lower and maintain Condition Class 1 on 150,000 acres in fire-adapted ecological communities. This estimate is based on restoring 5,000 acres per year while maintaining a five-year average fire-return interval in maintenance.

Hazardous Fuel Reduction

The number of wildfires, their intensity, and location could be directly or indirectly affected by different alternatives depending upon the relative amount of prescribed burning and other vegetation management implemented. Alternatives C, D, and E, with relatively more vegetation management than Alternatives A or B, may more greatly affect fuel models, fuel profiles, and fuel loading. Fuel profile changes resulting from restoration work (an emphasis in Alternative C) would result in a greater percentage of the landscape with herbaceous understory conditions. The tons of fuel per acre in restored areas would be slightly less in this alternative versus others. A change in fuel profiles in Alternative C to grassy fuels could create a "flashier" fuel type in restoration areas. This fuel type is more easily ignited. Rates of spread might also be higher in these fuels as compared to other prevailing fuel conditions. On the other hand, fires in grass fuel models are generally more easily suppressed in this fuel model and typically result in smaller-sized fires with fewer smoke impacts. Wildfires in restored stands are significantly less likely to cause overstory mortality.

Alternative C, with the greatest amount of prescribed burning, would treat the largest acreage where hazardous fuel conditions currently exist. This alternative would create the highest number of Condition Class 1 lands. The areas fully restored to reference conditions would be at considerably less risk of catastrophic fire and more ecologically stable as fire-adapted ecosystems. To a lesser extent, Alternatives D and E would also lead to more acres of Condition Class 1 lands than Alternatives A or B.

Smoke Management

Implementation of any of the alternatives produces direct and indirect effects from smoke. Alternative C produces the most smoke-related direct effects (as a result of prescribed burning) of any of the alternatives. Alternative A would produce the least smoke-related direct effects (see also Smoke discussion under Cumulative Effects).

Safety and Snags

The risk to the public and firefighters from snags would be slightly reduced if any of these alternatives were implemented. Firefighter and public safety would be greatest in alternatives where vegetation management activities are emphasized (particularly Alternatives C, D, and E).

Alternatives C, D, and E might also affect initial attack fire suppression activities differently than Alternatives A and B for ground forces. Greater access as a result of road building or other development could facilitate faster mobilization of both staffing and equipment to wildfires. The indirect effect would be fewer large fires and probably less need for the use of aerial firefighting forces (helicopters and airtankers).

Cumulative Effects

Fire Regime and Condition Class

Alternatives with the most active management (most acres treated) would eventually lead to conditions with the least risk of catastrophic fire. At the landscape level, Alternatives C, D, and E would cumulatively reduce (mitigate) hazardous fuels most over time (see FRCC discussion above). The converse would be true of Alternative A and B where less of the landscape would likely be impacted by vegetation management activities. Restoration activities in fire-adapted ecological communities (as emphasized in Alternative C) could require multiple vegetation management treatments but would eventually lead to the most sustainable and naturally functioning ecosystem conditions.

Smoke Management

Elevated emissions and nuisance smoke would occur in all alternatives, but would be highest in Alternative C. The potential cumulative effect from smoke resulting from prescribed burning would be highest in Alternative C. These effects would be of short duration (generally less than 12 hours), and would only be cumulative when multiple prescribed burns or wildfires were occurring in the same airsheds on the same day. Prescribed burning would result in some reduction of larger fuels, which produce the most long-term smoke when smoldering. Over time, potential emissions from these larger fuels on wildfires or prescribed burns could become less of a problem. Consequently, alternatives that result in implementing the largest vegetation management programs are more likely to result in the greatest reduction of large fuels. Alternative C would also create conditions favoring more rapid decomposition of large woody fuel restoring more open (reference) conditions.

Wildfire Suppression and Cost

Over time, the cumulative cost of wildfire suppression could be less in Alternative C and D (respectively) because of hazardous fuel reduction work and other activities associated with vegetation management. These cost savings would be reflected in both the initial attack response time, equipment, staffing costs (ground versus aerial) and ease of control based on fire intensity.

ROADS, TRAILS, AND ACCESS

Access to the OSFNFs is provided by an interconnected transportation system of roads and trails managed by the Forest Service, county and state agencies, and private individuals. Travel is an integral part of virtually every activity that occurs on the Forests and is necessary for outdoor recreation; fighting wildfires; management of livestock, wildlife, and commodity resources; access to private in-holdings; maintenance of communication sites and utilities; and monitoring. Commercial trucks, automobiles, high clearance vehicles, four-wheel drive vehicles, off-highway vehicles, motorcycles, mountain bikes, hikers, horseback riders, and even some wheelchairs use the forest transportation system.

Travel management includes planning and developing facilities to provide access into and across USFS system lands. While traditional access for commodity output (timber products) on the Forests has remained constant, access demands for recreation and non-motorized travel are increasing. If natural resources and ecosystems are to be protected while trying to accommodate the increased access demands of expanding uses, development of a comprehensive and coordinated road and trail system is essential with consideration for the protection of wildlife habitat, species diversity, watershed condition, vegetation, and soils.

Affected Environment

The transportation inventory for the OSFNFs consists of two parts. Part One is the spatial data contained in the GIS, which records the location of individual roads and trails. The spatial data may be used to produce maps at various scales. Part two of the inventories is a computer database (INFRA) containing descriptive details such as structural information, jurisdiction, and maintenance activities. Records include all forest system roads, forest highways, forest system trails, and bridges. Information for the forest transportation inventory is updated as survey information becomes available. Records are updated when changes are made in the field, management changes occur, and technological improvements are made. A forest-scale roads analysis process (RAP) was completed to inform the Forest Plan Revision process. The RAP was completed in accordance with FSM 7712.

National Forest Jurisdiction System Roads

The forest transportation system currently contains approximately 320 miles of roads designed for passenger cars. The remaining approximately 5,570 miles are designed for high clearance vehicles with over half of those planned for closure to motorized vehicular traffic for periods of a year or more (when not needed for resource management activities). Roads under county and state jurisdiction that provide access to the Forests' roads compliment the Forest Service jurisdiction transportation network. In addition to providing public access, the road system provides access to administer, to protect, and to utilize USFS system lands. Travel management planning provides public access opportunities tempered by restrictions necessary to achieve land management and resource protection objectives.

The Forests completed 764 miles of road construction/reconstruction work between 1987-2003, which averages 46.7 miles per year. The most recent years have been somewhat under that average primarily because of appeals, and the concentration of the timber program on salvage sales that generally do not need as much specified roadwork. Table 3-190 displays the number of miles of road construction/reconstruction done from 2001-2003 and shows the distribution of miles for new construction/reconstruction during this period. Table 3-190 also shows the number of reconstruction miles directly related to timber sales.

Table 3-190: Total Miles of Construction/Reconstruction on OSFNFs from 2001-2003.

Year	Total Miles-Construction/ Reconstruction	New Construction	Reconstruction (Miles in Timber Sales)
2001	33.4	1.1	32.3 (17.8)
2002	47.8	2.9	44.9 (43.8)
2001	30.3	1.1	29.2 (27.0)

Some reductions in road construction and reconstruction programs were the result of a reduced timber sale program and reduced appropriations for capital investment. As a result, the condition of many of the Forests' primary access roads fell below the standard to safely and efficiently support the current traffic volumes. Trends indicate traffic volumes will increase, especially from recreation-oriented forest users.

Management objectives are established for all roads and provide construction standards and maintenance levels. Vehicle types, expected traffic volumes, user types, environmental constraints, and economics are considered when determining the appropriate standards to be applied.

Road Function Class

The National Forest Jurisdiction System roads provide access in a branching system consisting of three functional classes: arterial, collector, and local roads. Arterials provide access to large land areas, typically linking county roads, state highways, or communities. Because of the larger volumes of traffic they carry, arterials have the highest standards for construction and maintenance. Collector roads disperse traffic from arterials onto large forest areas. Local roads, used to access specific project areas or sites, are usually less than two miles long and of lower standard construction. Table 3-191 displays the total miles of National Forest System roads currently on the OSFNFs by functional class.

Table 3-191: Jurisdiction Roads on OSFNFs by Functional Class.

Functional Class	Miles
Arterial	34
Collector	114
Local	5,742
Total	5,890

Source: INFRA Travel Routes

Traffic Service Level

Roads are also characterized by traffic service levels (TSLs). Traffic service levels describe a road's significant traffic characteristics and operating conditions. Transportation planning activities identify the required TSL. Table 3-192 displays TSLs

for all FS roads. TSLs represent the significant traffic characteristics and operating conditions for a road: Level A (most efficient and free flowing) through Level D (single-purpose, low volume).

Table 3-192: Jurisdiction Miles on OSFNFs by Traffic Service Level

Traffic Service Level	Miles
A	56
B	31
C	338
D	5,465
Total	5,890

Source: INFRA Travel Routes

Roads Maintenance Level

National forest roads are maintained to assure that planned service levels and user safety are preserved and that impacts to soil and water resources are minimized. Utilizing the annual road maintenance and prescription process, road maintenance needs are identified and cost estimates are prepared. Through the road maintenance planning process, priorities are determined and negotiated based upon available funding levels. Each road is assigned a maintenance level (ML) 1 to 5 based on road use objectives. These objective MLs prescribe the upkeep and restoration work necessary to retain a desired traffic service level. Road maintenance levels (ML) are:

- **ML-1 roads** are closed to vehicular traffic and receive custodial maintenance only, primarily for resource protection (open when needed for management activities such as timber sales, follow up reforestation needs, planting, etc.)
- **ML-2 roads** are maintained to provide for passage of high clearance vehicles. Roads receive minimum maintenance.
- **ML-3 roads** are maintained for travel by the careful driver in standard passenger vehicles. The comfort and convenience of the user is a low priority.
- **ML-4 roads** provide a moderate degree of driver comfort and convenience.
- **ML-5 roads** are maintained for a high degree of driver comfort and convenience. Road surfacing is usually asphalt.

The transportation system on the OSFNFs is maintained primarily through service/construction contracts with local contractors and by timber purchasers as part of timber sale contracts.

Table 3-193 shows the number of miles in each ML. Any future changes to the existing system would only occur through completion of a road analysis process (RAP) and the issuance of a subsequent decision document.

Table 3-193: Miles of Travel Ways by Road Objective Maintenance Levels.

Level	National Forests Miles
1	2,854
2	2,716
3	233
4	56
5	31

Source: INFRA Travel Routes

A number of variables affect road maintenance capabilities. Budget allocations vary from year to year and from forest to forest, making it difficult to predict final budget allocations. No direct link exists between forest plan budget requirements and Congressional allocations; therefore, forests have no assurance that final budget levels will equal those stated in their forest plans.

Road maintenance budgets have fluctuated during the past 17 years, while traffic volumes on the Forests' road system have increased. The now declining and past fluctuating budgets have resulted in roads not being maintained to the level prescribed in management objectives.

County governments continue to provide maintenance on some forest roads, but at reduced levels. Local population growth has increased the burden on county road systems, while budgetary constraints have concentrated maintenance priorities on roads closer to urban areas.

Even though commercial use of the Forests' road system has declined somewhat, the recreational traffic has increased substantially. The arterials and major collectors that connect the Forests to urban areas have experienced increased day-use traffic, particularly on weekends. This traffic increases the maintenance work necessary to keep the roads in a safe and structurally sound condition.

Continued growth in recreation use, without increases in the road system mileage, may cause lower visitor satisfaction and increased conflicts among competing recreational activities. New road construction for recreational purposes is expected to be very low to none.

Road decommissioning occurs when a road is no longer needed for resource management. Roads are also candidates for decommissioning when maintenance requirements and resource impacts outweigh access needs. Decommissioning includes various technologies to stabilize and rehabilitate unneeded roads such as:

- Blocking the road intersection,
- Revegetation,
- Water barring,
- Removing fills and culverts,
- Re-establishing water drainages,
- Removing unstable road shoulders, and
- Full obliteration by recontouring and restoring natural slopes.

A RAP will inform decisions regarding all road decommissioning. Road decommissioning has averaged eight miles per year for the last three years (2001-2003).

The rate of increase in motorized travel on the Forests has outpaced their ability to maintain the transportation system. Reports developed in response to inquiries regarding backlog and deferred road maintenance indicate that the Forests have been maintaining less than 15 percent of the road system to standard. Requirement to protect water quality, fish and wildlife habitats, etc. also affect the degree to which motorized access can be provided.

The annual roads accomplishment report for FY 2003 indicated approximately 10 percent of the roads under the Forests' jurisdiction were maintained to their objective maintenance level. In Fifteen percent of the Forests' system roads had some degree of maintenance performed on them in FY 2003.

Potential Public Forest Service Roads

The Forest Service is considering designating certain Forest System Roads as public roads. By definition, a Public Forest Service Road (PFSR) is a National Forest System road that is designated "open to public travel" in accordance with 23USCs101(a). The roads must serve a compelling public need. By definition, the roads would remain open and be subject to Federal Highway Safety Act requirements. Exceptions would be for scheduled seasonal closures or emergency closure needs. To date, and per agreement with the Federal Highway Administration, ML 3 to ML 5 roads have been subject to the Federal Highway Safety Act requirements, but without the public road designation. The Forest Service has identified potential roads for PFSR classification, along with construction work, which would be required to bring these roads up to the standards necessary for a public road. The Forest Service Region 8 Regional Office has prioritized the projects to be accomplished as money becomes available. PFSR designation is still preliminary and is subject to change, modification, and approval. Further analysis through travel management, road analysis, public involvement, and decision documentation is also required.

Unclassified Roads and Trails

Non-system roads and trails are referred to as unclassified roads and trails. Unclassified roads or trails are roads or trails on National Forest System lands that are not managed as part of the transportation system. This class of traveled way includes unplanned roads, abandoned traveled ways, and OHV tracks that have not been designated for use. Unclassified roads include roads once under permit or other authorizations that were not decommissioned upon the termination of the authorization. Many of these routes have been created by recreation use. Some of these routes are older timber and range roads that no longer serve the purpose for which they were intended, but were not properly closed.

Decisions will be made in project or watershed level decision documents to designate these routes or eliminate them. In most cases, the objective will be to eliminate the

routes along with all subsequent routes created there after by obliteration as funding is available. Any new route, road, or trail that needs to be created will have to have a compelling need and go through the proper analysis process before construction.

Bridges and Major Culverts

There are seven FS jurisdiction inventoried road bridges and two FS jurisdiction major culverts (open-end area equal to or greater than 35 square feet) on the Forests that are open to public travel and have a span length greater than 20 feet. These bridge structures are subject to National Bridge Inspection Standards (NBIS) and currently are being inspected every two years. Of the NBIS structures inspected to date, almost $400,000 in repair and/or replacement costs have been identified as necessary to bring one present structure (Barkshed Bridge) up to state legal load requirements. There are also 112 trail bridges on the Forests. When inspections are performed, they are intermittent and occur only when specifically requested by field personnel. Local knowledge indicates that maintenance has been lacking on most trail bridges and some are in need of full replacement.

Future Trends

The past 17 years have brought a shift in the volume and mix of travel modes on the Forests. All forms of recreation travel have increased in volume, particularly the OHV-type use.

Variation in volumes can be attributed to a number of reasons. Factors include technology advances (larger 4x4 OHVs), economic conditions, changing demands for recreational experiences, population increases, and other social influences. Along with the multitude of diverse uses of National Forest System lands has come an increasing demand for segregating those uses. The following are common conflicts in uses of the National Forest System lands: hikers and horseback riders vs. mountain bikers; OHV users vs. full-sized motor vehicle users; and OHV users vs. hikers, horseback riders, and mountain bikers.

Direct and Indirect Effects

Roads and Access

The forest transportation system provides access to the forest for administrative management, hunting, fishing, timber harvest, sight seeing, and numerous other activities. This system includes federal and state highways, county roads, and Forest Service roads, (roads under the jurisdiction of the Forest Service). Travel on the Forests is occurring on paved roads, gravel roads, and primitive woods roads. 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 Forests to protect soil and water resources, reduce wildlife disturbance during certain seasons, and resolve user

conflicts. Management of the various resource programs determines the need for further development (construction and reconstruction), maintenance, and use of roads.

Table 3-194 summarizes possible road activities indicated from the SPECTRUM Model for each alternative for the next 5 decades.

Table 3-194: Possible Road Activities for Decades 1-5.

Road Activity by Decade	Alternatives				
	A	B	C	D	E
Road Activity-Decade 1	**Miles/Decade**				
Road Reconstruction	163	133	156	154	146
Road Construction	41	33	39	42	37
Road Maintenance	4,888	3,997	4,692	5,027	4,406
Road Construction-Temporary	489	400	469	503	441
Road Activity-Decade 2	**Miles/Decade**				
Road Reconstruction	163	133	156	154	146
Road Construction	41	33	40	40	37
Road Maintenance	4,888	4,011	4,747	4,858	4,403
Road Construction-Temporary	489	401	475	486	440
Road Activity-Decade 3	**Miles/Decade**				
Road Reconstruction	163	133	156	177	149
Road Construction	41	34	39	51	38
Road Maintenance	4,888	4,021	4,719	6,065	4,561
Road Construction-Temporary	489	402	472	607	456
Road Activity-Decade 4	**Miles/Decade**				
Road Reconstruction	163	133	156	177	149
Road Construction	41	34	39	47	40
Road Maintenance	4,888	4,055	4,694	5,657	4,758
Road Construction-Temporary	489	405	469	566	476
Road Activity-Decade 5	**Miles/Decade**				
Road Reconstruction	163	133	156	177	161
Road Construction	41	34	39	44	40
Road Maintenance	4,888	4,044	4,694	5,326	4,834
Road Construction-Temporary	489	404	469	533	483

Note: Numbers Are Only Estimates Based on Projected Activities in the SPECTRUM Model

Transportation Management & Recreation

Increasingly, National Forest System and other public lands are likely to be the destinations of choice for people looking for high-quality outdoor recreation experiences in natural settings. Travel, whether by car, OHV, horse, or foot is fundamental to the enjoyment of the national forests. Recreation travel by passenger vehicle is the fastest growing segment of forest traffic. The forest recreation strategy of emphasizing dispersed opportunities will likely cause this segment to increase more in the future. The greatest impact on roads often comes 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.

Dispersed Recreation on the Forests is projected to increase over time and Alternatives B, A, E, C, and D (least to the most road improvements/maintenance based on summarized SPECTRUM Road Activity Table 3-194) are the most likely able to meet that need.

Developed recreation facilities may increase slightly under Alternatives B and E, if cost effective; would continue at about the same level with Alternatives A and D; and would have a slight decrease with Alternative C. These relatively minor changes in developed recreation 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 small number of roads be reconstructed and improved to meet traffic and vehicle demands.

The potential for crowding, user conflicts, and reduction in the quality of the experience would increase with more recreation demand. These demands could result in the demand for more roads to have restoration work rather than maintenance.

Transportation Management & Vegetation Management

Through timber management, timber products become available for the consumer. In order to manage timber, roads are necessary for access and haul. The majority of all needed roads are in place to access the timber; however, some may need improved and a limited number of new roads may be necessary to access identified sales units. Because of economic or resource concerns that warrant restrictions, any new roads will usually be low standard and usually closed to public motorized access when no longer needed for resource management activities, or they will be only temporary roads and, therefore, completely rehabilitated.

Timber harvesting activities would require road construction and reconstruction under all alternatives for all periods. Alternative B, A, E, C, and D have the least to the most road improvements based on the summarized SPECTRUM Road Activity Table 3-194. Alternatives A and B would remain at about the current road improvements work level while Alternatives C and E would be expected to increase slightly. Alternative D would have the largest increase in roadwork needed to meet vegetation management needs.
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 or purchaser performed maintenance resulting in more miles of roads maintained to standard.

The emphasis on protection of threatened and sensitive plants and planting of native species is increasing the cost of road maintenance and restoration work. New requirements to eliminate invasive species and to plant more native species will increase cost of some vegetation establishment and maintenance along roads. The alternatives with the most roadwork would see the heaviest impact from vegetation manipulation.

Transportation Management & Soil and Water

Soil properties and topography vary a lot among the many different geographic locations on the Forests. These factors have a tremendous effect on the location, design, maintenance, and operation of roads on the Forests. The climatic conditions in relation to the period of heaviest usage have a direct impact on the soil and water effects of the roads. Some soils require higher standard roads for resource activities such as timber harvesting and hunting in that they need more drainage work and base stabilization (aggregate) to prevent excess soil movement.

Greater emphasis is being placed on maintaining the water quality, riparian areas, and soil stability. Roads can contribute to their degradation if not properly designed and maintained. There are techniques that can reduce and mitigate these impacts and the Forest Service is taking greater strides to administer these techniques to improve watersheds including using Best Management Practices on all road improvement projects. Alternatives that have fewer roads would have fewer impacts and most likely these would be Alternatives B, A, E, C, and D (least to the most road improvements/maintenance based on summarized SPECTRUM Road Activity Table 3-194). Good road 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

Transportation Management & Wildlife

The main impact to roads is heavy use during the normally wet fall hunting season. Alternatives B, A, E, C, and D have the least to the most road improvements based on the SPECTRUM Road Activity Table 3-194. Alternatives A and B would remain at about the current road improvements work level while Alternatives C and E would be expected to increase slightly. Alternative D would have the largest increase in roadwork.

The planting of closed roads for wildlife openings can help maintain the roadbed during long periods of nonuse. Protection of some bird species during nesting season can require the closure of some roads, which can help reduce road maintenance costs. Protection of species may also require limiting of maintenance activities that could adversely affect road and ditch stability.

Cumulative Effects

An extensive travel system was developed from the late 1800s to the present in order to access timber, private lands, and popular recreation sites. As time went on a more

extensive network was developed to accommodate continuing management and public needs. Presently there is a greater demand for a variety of recreation uses in both motorized and non-motorized settings. The current system is made up of a combination of roads and trails with varying degrees of user comfort and uses. The current system is also in place for land managers to continue to access areas for resource management. Restricting travel to designated routes, which is the current forest plan direction, will decrease resource damage to the land. This will also, however, increase the need on the Forests for a good network of roads and trails to accommodate additional recreation use such as 4-wheel driving, OHV, motorcycling, and mountain biking.

As travel to and through the forests increases, there will be an increase in impacts on surrounding public roads. County roads will be affected the most. Congestion may increase on state roads especially during peak recreation periods. All types of recreation use will significantly increase in volume on the forests. The level of commercial forest product traffic using heavy trucks is not expected to increase significantly.

As populations grow and urban development expands near the OSFNFs, the continuous use of forest roads and trails will increase. The forest arterials and major collectors that connect the forest to these areas will experience the most increased day-use traffic, particularly on weekends. This traffic adds to the maintenance work necessary to keep the roads in a safe and structurally sound condition. Lands administered by the Forest Service immediately adjacent to population centers are affected the most by user-created trails that access the Forests from residential properties. Under all alternatives, continual coordination and collaboration with national, state, and county officials in the management of transportation facilities to and through the forests would be continued to ensure that access is maintained, standards are consistent, safety issues are addressed, and efficiency is considered at all times.

The Forest Service is required by law to provide reasonable access to private in-holdings. The type of access for an in-holding may be determined by the location, type of access needed, and number of access points in one location. As ownership changes, the access required may also change.

Overall, the transportation system for the OSFNFs will strive to be efficient and safe, provide access to areas of interest, and provide for the variety of modes of transportation used by all.

Facilities - Administrative and Other (FA&O)

Affected Environment

There are various administrative sites on each of the seven districts on the OSFNFs. These vary from specialized facilities such as the Clarksville Helibase located on leased property at the city-owned airport in Clarksville, AR, to ranger district officers that include other buildings such as at the Bayou Ranger Station Administrative Site located

in Hector, AR. In addition, Cass Job Corps Center is located on State Hwy 23 on the Pleasant Hill Ranger District. Most of these are older facilities, but a new Sylamore Ranger District Office is currently planned for construction in FY 2006 and a rehabilitation/expansion project for the Supervisor's Office is planned for FY 2007/ FY 2008.

An updated OSFNFs Facility Master Plan was completed in FY 2003/FY 2004 and was approved by the Regional Forester on March 8, 2004, and is on the R8 internal web page under Engineering, Facilities. This updated master plan identified over 160 buildings/structures (including old lookout towers, old powder houses, seed tree coolers, etc) and identified 24 as surplus that are to be disposed. One of these identified for disposal (Pleasant Hill Administrative Site Office Trailer) was disposed of in FY 2004. In addition, legislative authority to dispose of excess administrative sites in Arkansas (seven are on the OSFNFs) was passed by Congress and signed into law by the President on October 21, 2004. None of the seven sites identified in the legislation have been disposed of yet, but some should be disposed of in the next few years.

There is also a new method to fund the maintenance of FA&O buildings starting in FY 2006. Each forest will be accessed a cost pool amount (based on square footage of FA&O buildings in the Infrastructure [INFRA] data base) that will be pulled from all Expanded Budget Line Items (EBLIs) at the WO level and allocated back to the units where collected to do the FA&O facility maintenance work. The cost pool assessment is around $1.50/ft for the first year and will gradually increase each year at a rate determined at the WO.

Direct and Indirect Effects

Facilities costs would increase due to the aging of the existing buildings at the various administrative sites. However, there would be no significant changes in FA&O building infrastructures among the alternatives. Under any alternative, offices, work centers and other various administrative sites would still be needed to manage the OSFNFs

Cumulative Effects

There are no known cumulative effects on infrastructure.

Dams

Affected Environment

There are 11 dams identified in INFRA on the OSFNFs. Seven are Forest Service owned/maintained dams. Several such as Lake Wedington, Cove Lake, and Spring Lake were constructed by the CCC/WPA in the 1930s. Some such as Bear Creek and Storm Creek Lakes on the St. Francis NF were constructed by other agencies in the 1950s before the lands were transferred to the Forest Service.

There are four non-Forest Service owned/maintained dams on NF lands (e.g., Upper and Lower Brock Creek Lakes) that were constructed by the Natural Resources Conservation (NRC) for the local Soil Conservation District.

Direct and Indirect Effects

There would be no significant changes in among the alternatives.

Cumulative Effects

There are no known cumulative effects on infrastructure.

LANDS/SPECIAL USES

Affected Environment

The OSFNFs consist of approximately 1.2 million acres of publicly owned land within the proclaimed forest boundary area, which covers about 1.55 million acres. Of this total, the St. Francis NF comprises 21,090 acres of publicly owned land within the proclaimed forest boundary of about 30,000 acres. About 24 percent of the land within the proclamation boundary of the Ozark NF is private land or lands administered by state, local or other agencies (Table 3-195). This results in an intermingled ownership pattern of private and public lands, which causes some forest tracts to be inaccessible to the public and more difficult for the Forest Service to manage. It creates a need for legal access to these isolated tracts of land. Rights-of-way acquisition is an ongoing part of the lands program, and is critical for providing public access and for improving management of the public lands. Acquisition and conveyance of land are also used to solve access problems, with priority decided on a case-by-case basis according to guidelines established by law, the forest plan, and Forest Service regulations.

Table 3-195: Land Ownership.

Land Ownership	Acres	Percent Ownership
Ozark NF within the proclamation boundary	1,161,012	76%
Other Lands within the Ozark NF proclamation boundary	359,436	24%
St. Francis NF within the proclamation boundary	21,090	70%
Other Lands within the St. Francis NF proclamation boundary	8,910	30%
Total Acres	1,550,448	

The OSFNFs' current LRMP addresses the need to acquire lands through purchase or exchange in order to consolidate ownership for improved management and acquisition of needed rights-of-way, as well as providing for other resource and community needs.

Forest History

The Ozark NF was established in 1908 by President Woodrow Wilson, and consisted of 917,944 acres. In 1909, President Wilson added an additional 608,537 acres to the proclaimed boundary area. Two subsequent proclamations reduced the boundary area. Other proclamations reconfigured the forest boundaries somewhat to form the current Ozark NF. The St. Francis NF was a former land-utilization project area consisting of 20,616 acres in southeast Arkansas. In 1960, this public area was given national forest status and named the St. Francis National Forest. The St. Francis and Ozark were joined together for administrative purposes, and these forests have been known as the Ozark-St. Francis National Forests since that time. Both forests are a mix of public domain and acquired lands. ("Public domain" lands are those lands that have never been out of federal ownership. “Acquired” lands are those lands that have been purchased by the federal government from private ownership).

Land Adjustment

Land activities on the Forests are varied and include acquisitions, exchanges, transfers, donations, asset forfeitures, encroachments, and resolution of claims. The mixed ownership pattern within the Forests results in requests to utilize national forest land for a variety of purposes, some of which are outside the scope of Forest Service mission, policy, and regulation. Intermingled ownership creates occasional conflicts concerning property boundaries, title claims, encroachments, and access. It also limits fulfilling the desired management potential of certain resources. Many private lands are purchased as second home sites to be adjacent to national forest land. Acquisition by the Forest Service of private land benefits use and management of the Forest. Acquisition of such land would be largely through exchanges or willing-seller purchases and is primarily contingent on Land and Water Conservation Funds LWCF. Since 1987, 24,424 acres have been acquired through purchase and donation for an average of about 1,437 acres per year. Land exchanges over that same time period have averaged about 284 acres per year. However, in two of the last three years, land purchase and exchange programs have both been drastically reduced, mostly due to lack of congressional funding (Table 3-196).

Table 3-196: Land Adjustments on the Ozark-St. Francis National Forests 1987-2004.

Year	Acres Exchanged	Acres Purchased
1987-1996	3,016	18,710
1996-2001	1,880	3,276
2002	0	80
2003	0	2,229
2004	0	129
Total	4,896	24,424

Landlines

The OSFNFs have not had an adequate landline refurbishment/maintenance program for the past 8 to 10 years due to budgetary limitations. The OSFNFs have over 3,200 miles of landlines with approximately 1,100 miles of boundaries still to be surveyed and marked to Forest Service standards. Because landlines should be maintained on a 10-year interval, approximately 210 miles of maintenance should be accomplished each year just to keep from losing the 2,100 miles already marked to standard in the past.

Rights-of-Way Acquisition

The OSFNFs have an active right-of-way (ROW) acquisition program, acquiring an average of three to seven ROWs per year. As a rule, these ROWs allow the FS the right to use private land for travel to and from NF lands for purposes connected with the protection, administration, management, and utilization of the public's resources. The Forests leave management of the ROWs to the private landowner except as needed for entering and exiting USFS property and/or any rights extended to others as allowed by the ROW document.

Title Claims and Encroachments

The OSFNFs, as stated above, have over 3,200 miles of boundary landlines. On average, there are two encroachments per each mile of landline with each encroachment averaging one-half acre. This equates to 3,200 acres of NF land being under encroachment. While under encroachment, this acreage is effectively removed from management by the National Forest.

Special Uses

Affected Environment

Special uses management is a major activity within the NF Lands Program. The OSFNFs administer about 600 permits that authorize 64 different types of uses (Table 3-197). The land required for these special uses is approximately 12,500 acres. Of this total, granted rights-of-way occupy about 1,700 acres.

Special-use authorizations often affect land far beyond the area actually authorized and occupied. As an example, many of our granted rights-of-way are for state and county highways. These highways require a buffer around them for restricting timber cutting, mineral extraction, etc. Another example would be the restricted use of prescribed fire near an authorized special use.

Occupancy and use of national forest lands by federal, state, and local agencies, as well as private industry and individuals, are authorized with special-use permits, leases, and easements. Several different public laws regulate activities under special-use authorizations. The Organic Act of 1897 and the Federal Land Policy and Management Act (FLPMA) of 1976 authorize the majority of the uses. Demands made

on the Forests for different types of special-use permits are growing each year. Each application for a permit is screened and evaluated to determine if it is allowed by law and if it is in the public's best interest. No permits for occupancy of national forest lands can be issued unless authorized by a specific law.

The St. Francis NF has 52 recreation "summer" home residences under special-use permit within its boundaries. The Bear Creek Lake Homeowner's Association has proposed a land exchange with the St. Francis NF in which they would acquire the peninsula on which their recreation residences currently set. The nonfederal tracts they have offered to date do not satisfy the criteria or value for a land exchange. The Forest Service owns all property surrounding Bear Creek Lake. A site-specific environmental analysis (EA) of any proposal would be required to show whether or not it met the laws and regulations governing such conveyance, and that the exchange would be clearly in the public's interest.

Table 3-197: Major Special-Use Permits on the OSFNFs.

Type of Permits	Number of Permits
Recreation	77
Agriculture	19
Community and Public Information	22
Research, Study, and Training	6
Road and Trail Rights-of-Way	233
Communications Tower Uses	31
Water Uses	61
Electric, Telephone, and Natural Gas Rights-of-Way	36

Granted Rights-of-Way

The OSFNFs administer 233 (this amount fluctuates) special-use authorizations in the form of one-year permits, multi-year permits, and 30-year easements with the option to renew after 30 years. The current amount of land affected by these uses is about 1,700 acres. The acres change from year to year because of additional uses or the temporary nature of some of these uses. This current reported use of 1,700 acres could actually affect a much larger area because of restrictions near and adjoining the authorized use.

Direct and Indirect Effects

Land Adjustment and Rights-of-Way

In all alternatives, the mixed ownership pattern on the Forests would continue to provide opportunities for land adjustment through exchange, purchase, donation, and acquiring of rights-of-way. Obviously, congressional appropriations and Land and Water Conservation Fund (LWCF) funding affect these activities. There are slight differences in the alternatives that would tier to the priorities established for acquiring land and

rights-of-way. Alternative A would emphasize those items noted in the current LRMP and its amendments. In Alternative B, lands needed for increased production of goods and services would be first priority, namely those quantitative goods such as timber and qualitative services such as recreation. Rights-of-way might increase if required for increased production of these goods and services. Alternative C would emphasize restoration of ecosystems, and any land adjustment would be prioritized based on ecosystem needs. Likewise, rights-of-way would be adjusted as influenced by ecosystem needs. This alternative might lessen the needs for additional rights-of-way. Alternative D would emphasize balancing (timber) age classes across the Forests. Land adjustment would be tiered to proficient management of forestlands, especially as related to timber management activities Rights-of-way would likewise be adjusted proportionately to timber management needs, and this alternative would probably result in a slight increase in needed rights-of-way. In Alternative E, emphasis is placed on a selected combination of all alternatives. Water quality, recreation opportunities, sustainable forest ecosystem management, species habitat, and a quality forest transportation network are all emphasized. Land adjustment would be evaluated based on meeting these needs and outputs. Emphasis of a high quality forest transportation network might lead to a slight decrease in new rights-of-way, and increase in the quality of roads over existing rights-of-way.

Overall, having legal access to NF land is a critical aspect of implementing the strategies of any of the alternatives. The primary reasons and emphasis stated for land acquisition in the alternatives would also be relevant for acquisition of rights-of-way.

Special Uses

With a fragmented ownership pattern, the requests for use of NF land including access will not change substantially with any of the proposed alternatives. Special use proposals will continue to be processed, and new and existing authorizations administered in accordance with FS 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.

Cumulative Effects

Land Adjustment

Acquiring NF land usually results in positive cumulative effects by allowing the Forests to consolidate and, as needed, expand federal ownership. The effects 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 viewsheds. Additional positive effects include increased opportunities for recreational pursuits and areas with high quality resources such as water and timber. There are limited concerns from some individuals and government officials that acquisition of additional FS land would reduce the acres available for the property tax base. Additionally, as rural development

expands and land prices increase in some areas, the FS may be viewed as a competitor for remaining properties.

Land purchases are contingent on two factors. The first factor is money appropriated for purchase and administration of the land adjustment program. Secondly, escalating land prices could make purchases prohibitively expensive, thus pricing the Forests "out of the market."

Landlines

Maintenance of property lines on a reasonable rotation will allow the Forests to effectively manage federal land for forest users, and may result in fewer encroachments. Dependent resurveys to locate the property boundary lines are also an important part of our landline program, and result in better forest management.

Rights-of-Way

Acquisition of needed rights-of-way will have a positive effect on management in any of the alternatives. Access is critical to being able to implement desired future condition on the Forests, both from a resource management standpoint and for the visiting public. Acquiring access to all lands on the OSFNFs would have a positive effect.

Title Claims and Encroachments

Title claims and encroachments have negative effects. Time and money spent to resolve title claims or encroachments use critical resource funds needed in other areas of the Lands program.

Special Uses

There would be no cumulative effects of any of the alternatives on special uses.

SOCIAL AND ECONOMIC ENVIRONMENT

Affected Environment

The Ozark-St. Francis National Forests are located within the Ozark Mountains and include 1.2 million acres in parts of central and southeastern Arkansas. The Forests are headquartered in Russellville, Arkansas, and are managed for multiple uses, including timber and wood production, watershed protection and improvement, habitat for wildlife and fish species (including threatened and endangered ones), wilderness area management, minerals leasing, and outdoor recreation.

The following economic and social analysis of the OSFNFs will characterize demographic (social) changes; economic trends; values, attitudes, and beliefs; effects of national forest management on the local economy; and the efficiency of national forest programs to the tax-paying public.

Social attitudes, values, and beliefs are elements used to describe and understand the human dimensions 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 and demographic information form 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

One characteristic of an area used to determine how dynamic and subject to change it may be, is the growth of population and its various racial and ethnic components within the counties which comprise a national forest. A static area will imply few possible issues affecting change. Conversely, a dynamic growing population may produce many conflicting issues for land managers to consider. Certain areas of the National Forest System and surrounding lands, which are seen to be attractive to urban dwellers for recreation and second or retirement home residence, may produce issues, which conflict with traditional residents of the area.

Demographic changes are given for the forests; then a contrast is made with the state in which the forests reside. When data are available, contrasting data are usually made for the census decades of 1980, 1990, and 2000. Other data from non-census sources may present years that differ from these decadal periods. Tables in Appendix B present all counties within the forests' proclamation boundaries. At times, the narrative will point out unusual characteristics of individual counties, and will refer the reader to the appendix for further contrast with the remainder of forest counties. In some cases, data are combined for both forests unless it is important to show data separately.

Population increased by 11.9 percent from 1980-1990 in the Ozark NF counties, while it decreased by 16.7 percent in the St. Francis NF counties during the same period. This compared with 2.8 percent population increase for Arkansas. More currently, the change from 1990-2000 was 31.6 percent increase for the Ozark NF counties, and 6.8 percent decrease for the St. Francis NF. The state of Arkansas had a 13.7 percent population increase for the same period. Table 3-198 displays these figures.

Table 3-198: Population Changes from 1980-2000.

Area	% Population Change 1980-1990	% Population Change 1990-2000
Ozark NF Counties	11.9	31.6
St. Francis NF Counties	-16.7	-6.8
Arkansas	2.8	13.7

Benton County showed the most growth of the Ozark NF counties with over 24 and 57 percent growth for the 1980 and 1990 decades, respectively. The St. Francis NF counties showed population decreases over the last two decades. On both Forests,

several counties showed negative growth during the 1980s, but most counties in the forest areas showed strong growth during the 1990s. Total growth for the forest counties of the Ozark NF exceeded the growth of that of Arkansas, but not so for the St. Francis NF counties. Thus, little growth was evident in both the forest and the state populations during the 1980s, but growth picked up substantially in the 1990s for the Ozark NF and Arkansas.

Appendix B shows population characteristics (especially minority) for all counties. Table 3-199 illustrates significant minority population changes from 1980-2000 on all the counties within the forest boundary.

Table 3-199: Minority Population Change

Area	1980 % Minority	1990 % Minority	2000 % Minority
Ozark NF Counties	3.4	4.0	9.3
St. Francis NF Counties	54.0	56.4	60.3
Arkansas	17.3	17.3	20.3

Source: U.S. Census Bureau from USDA NRIS HD Model

Minority populations increased significantly from 1990 to 2000 within the Forests' boundaries. The minority share increased from 3.4 to 9.3 percent from 1980 to 2000 on the Ozark NF, and from 54 to 60.3 percent from 1980 to 2000 on the St. Francis NF. The minority population within Arkansas represented 17.3 percent of the entire population in 1980 growing to a 20.3 percent share in 2000. Opportunities for minority participation resulting from local minority visits have increased significantly over the decade of the 1990s. On the Ozark NF, however, the share of minority population is much less than that of the state in 2000.

Washington County had the least minority share at 13 percent while Phillips County had the greatest share at 60 percent. (Appendix B).

Population projection is often times a hard task to accomplish with accuracy. The EPA has made straight-line interpolation projections to 2012 for every county in the United States. Appendix B shows the population and percentage change for the counties in the OSFNFs. The two St. Francis NF counties are projected to continue to lose population. Benton, Crawford, Madison, and Washington Counties will continue to have the greatest population increases. The Table 3-200 gives an estimate of changes between 2000, 2005, 2010, and 2012 for the total forests and the state.

Table 3-200: Population Projections with Percentage Increases from 2000.

Area	2000-2005	2000-2010	2000-2012
Ozark-St. Francis NFs	10.1%	19.8%	23.6%
Arkansas	5.0%	9.7%	11.6%

The forest boundary counties are projected to grow about twice as fast as the larger base state of Arkansas over each period in the above table. The Ozark NF area continues to be viewed as a desirable place for people to relocate, as evidenced by the expected rapid growth of these counties.

Table 3-201 shows that population density was 45.1 people per square mile in Arkansas in 1990 while the population density for the counties in the Ozark NF was significantly higher at 73.7 people per square mile. Population density in 2000 increased to 51.3 persons per square mile in the state, a 14 percent increase, while the Ozark NF counties increased to 109.6, a 49% increase. Population density is especially large in Benton County with 181.3 and Washington County with 161.1 persons per square mile in 2000. In 2000, Newton County had the lowest population density of any county on either Forest at 10.5 persons per square mile. Counties in the St. Francis NF on average had a much lower population density then the Ozark NF. Other counties within forest boundaries had densities below 50 per square mile for 2000 (Appendix B).

Table 3-201: Population Density (Persons Per Square Mile, Weighted Averages.)

Forest	1990	2000
Ozark NF Boundary Counties	73.7	109.6
St. Francis NF Boundary Counties	35.4	32.6
Arkansas	45.1	51.3

Source: U.S. Census Bureau from USDA NRIS HD Model

The significance of these population changes is that the forest boundary population grew at a faster rate during the 1980, 1990, and 2000 decades than that of Arkansas, despite the overall rural character of the forest area. The St. Francis NF counties, meanwhile, continue to lose population.

The rural nature of the area is contrasted with the state in Table 3-202. (For a breakout of all counties within the forest boundaries see Appendix B.)

Table 3-202: Percentage of Population in Rural Areas

Counties	1980	1990	2000
Ozark NF Counties	62.6	60.2	60.3
St. Francis NF Counties	47.9	45.8	51.8
Arkansas	48.4	46.5	47.6

Source: U.S. Census Bureau from USDA NRIS HD Model

There was loss of rural share in the Ozark NF area from 1980 to 1990. The rural characteristic of the OSFNFs analysis area increased from 1990 to 2000.

The percentage of persons living in rural areas for the aggregated counties making up this area has decreased from 62.6 percent in 1980 to 60.3 percent in 2000. The St. Francis NF had a decline of persons living in rural areas from 1980 to 1990, then an increase to 51.8 percent in 2000. This compares with the less rural character of the state, which decreased from 48.4 to 47.6 during 1980 to 2000.

Table 5 of Appendix B indicates that Madison, Marion, Newton, Searcy, Stone, and Van Buren Counties were 100 percent rural in all three time periods. All counties except Benton, Washington, Crawford, and the St. Francis NF counties have become slightly more rural from 1980 to 2000.

There appears to be a significant rise in population growth in many of the counties around the OSFNFs analysis area in the 1990s, a characteristic that was absent during the 1980s. The rural characteristic of the area, however, increased showing the extreme growth in some counties, and the decline of growth in others. It is clear from the analysis that northwest Arkansas has seen tremendous growth over the last two decades. This growth is expected to continue.

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 that area. For the Ozark NF analysis area, the per capita income average was $10,455 and $16,904 in 1990 and 2000, respectively. For the St. Francis NF the per capita income average was $6,658 and $11,867 for the same decades. Per capita income for Arkansas was $10,520 and $16,904 for the same years. Per capita income is slightly less in the Ozark NF analysis area than that of the state. The per capita income for the St. Francis NF is significantly less than that of the state. This information is illustrated in Table 3-203.

Table 3-203: Per Capita Income.

Area	1990	1990 adjusted to 2000 $'s*	2000	Real Avg. Annual Change*
Ozark NF Counties	$10,455	$13,801	$16,904	2.0
St. Francis NF Counties	$6,658	$8,788	$11,867	3.0
Arkansas	$10,520	$13,886	$16,904	2.0

Source: U.S. Census Bureau from USDA NRIS HD Model.
***Real rates of increase were determined by inflating 1990 per capita income to 2000 with the Consumer Price Index Deflator.**

The real average change in forest area income from 1990-2000 was 2.0 and 3.0 percent for the Ozark and St. Francis NFs, respectively. This contrasts with that of the state's 2.0 percent per year average annual change from 1990-2000. Newton County was the fastest growing county for per capita income at a 3.9 percent rate per year on a real basis over the 1990 decade.

Income for the St. Francis NF area grew faster than Arkansas' income on a real basis (inflation adjusted) during the 1990s. Although income was at a much lower base, financial well-being increased at a greater rate in the St. Francis NF analysis area than that of Arkansas during this period. The Ozark NF average growth was equal to that of the state.

Another indicator of relative economic prosperity is the percent of unemployed workforce. Unemployment rates change dramatically over time, depending in large part on the national economy. Some areas, however, have protracted unemployment problems because of educational attainment and lack of skills.

In 2001, the Ozark NF had significantly less unemployment at 3.9 percent, than that of the State (Table 3-204). The St. Francis NF, however, had a significantly higher unemployment rate of 9.9 compared to the State's 5.1 rate (Table 3-204). The Forests' unemployment rate was calculated as a weighted average (unemployment rate and number of unemployed) of all counties in the area.

Table 3-204: Unemployment Rate.

Area	1995	1998	2001
Ozark NF Counties	3.9	4.5	3.9
St. Francis NF Counties	10.3	9.7	9.9
Arkansas	4.9	5.5	5.1

Source: U.S. Bureau of Labor Statistics from USDA NRIS HD Model

During the period of 1995-2001, the unemployment rate for the Ozark NF analysis area was less then the rate of Arkansas, however they both increased and then declined from 1995 to 1998 and 1998 to 2001, respectively. The St. Francis NF analysis area's unemployment rate decreased by 0.6 percent from 1995 to 1998 and increased to 9.9 percent in 2001. Baxter, Marion, Newton, and Van Buren Counties had unemployment rates that were significantly higher than the Forests' average for 2001. Unemployment on the St. Francis NF has been close to 10 percent for the periods 1995-2001, some of the highest in Arkansas. On average, unemployment in the Ozark NF analysis area was significantly less than that of Arkansas.

The poverty rate is represented in Table 3-205.

Table 3-205: Poverty Rate Expressed in Percentages.

Area	1980	1990	2000
Ozark NF Counties	16.6	15.9	13.9
St. Francis NF Counties	41.2	44.3	31.8
Arkansas	19.0	19.0	16.0

Source: U.S. Census Bureau from USDA NRIS HD Model

Many counties in the OSFNFs analysis area had poverty rates in 2000 greater than the weighted average for the analysis area. Lee, Phillips, Newton, and Searcy Counties had the highest poverty rates of all counties in the analysis area. Benton County had the lowest rate in 2000 at 10.1 percent. Generally, all counties experienced declining poverty rates from 1980. The average for the St. Francis NF was significantly higher in 2000 (31.8%) than the state average of 16.0, while the average for the Ozark NF was lower (13.9 for the Ozark NF and 31.8 for the St. Francis NF). Since 1980, the poverty rate has declined slightly on the Ozark NF and by about 10 percentage points for the St. Francis NF.

Transfer payments from the federal government to the states and their citizens are another indicator of relative poverty in an area. Transfer payments are payments to persons for which they do not render services in the current period. As a component of personal income, they are payments by government and business to individuals and nonprofit institutions. Although most of transfer payments are made in cash, they also include payments for services such as Medicare, Medicaid, and food stamps. At the state level, approximately 90 percent of total transfer payments are estimated on the basis of directly reported data. The remaining 10 percent are estimated on the basis of indirect, but generally reliable, data.

Table 3-206 illustrates the analysis area average versus the state receipts of these payments from the federal government. The real growth rate in federal transfer payments for the Ozark NF analysis area was slightly higher than that of the State from 1970-2000.

Appendix B indicates that Benton County had a 5.8 percent growth rate of payments over this period. Lee and Phillips Counties on the St. Francis NF had payments growing only 2.2 percent and 2.4 percent per year, respectively.

Table 3-206: Federal Transfer Payments to Individuals.

Area	1970 (000 $'s)	1990 (000 $'s)	2000 (000 $'s)	Real Annual Change 1970-2000*
Ozark NF Counties	$535,571	$1,534,181	$2,242,856	4.9%
St. Francis NF Counties	$148,653	$168,522	$199,155	2.3%
Arkansas	$3,022,006	$7,598,406	$10,382,800	4.2%

Source: U.S. Bureau of Economic Analysis
***Real rates of increase were determined by inflating 1970 dollars to 2000 with the Consumer Price Index Deflator.**

Another factor indicating relative poverty and social disunity for an area is the percentage of households headed by a female member. The greater this percentage is, the more likely that these households may be on some form of government assistance. Table 3-207 contrasts the female head of households for both Forests (more specific forest information can be identified in Appendix B).

Table 3-207: Female Head of Households.

Area	1990 Female Head of Households (%)	2000 Female Head of Households (%)
Ozark NF Counties	7.4	9.1
St. Francis NF Counties	21.4	24.5
Arkansas	6.3	7.4

Source: U.S. Census Bureau from USDA NRIS HD Model

For 1990 and 2000, there were a greater percentage of female-headed households for the Ozark NF analysis area than for the state of Arkansas. For the same period, the percentages of female-headed households on the St. Francis NF were significantly higher than for the state. A higher female head of household for the Forests than the state may indicate less social cohesion from the extended family than exists in some areas of Arkansas. From 1990, however, the share of female-headed households with children present in the Ozark boundary counties has increased by almost two percent and almost three percent in the St. Francis boundary counties. This may be indicative of a higher divorce rate in the 1990s than before.

The number of persons per household also indicates economic status in a region. The greater the average number of persons per household, the less prosperous an area tends to be. Table 3-208 shows the comparison of the density of households in counties on the Forests versus the State. Appendix B gives more specific information about individual households in counties on the Forests.

Table 3-208: Density of Households

Area	1990 Persons Per Household	2000 Persons Per Household
Forest Boundary Counties	2.62	2.53
Arkansas	2.64	2.49

Source: U.S. Census Bureau from USDA NRIS HD Model

The change in household size from 1990-2000 decreased slightly for the Forests and the State. Most of the counties in the OSFNFs analysis area had household sizes that approximated the average for the Forests and the State. Enormously large households do not seem to be a characteristic of the OSFNFs analysis area.

Table 3-209 shows that the decade of the 1990s appears to be a decade of moderate growth for the Ozark NF counties. Housing unit growth from 1990 to 2000 was 32.5 percent for the Forests' area, while Arkansas showed a growth rate of 17.2 percent. For the St. Francis NF counties, however, it was a period of negative growth. Housing units declined in both Lee and Phillips Counties, and the housing vacancies increased over both decades. Housing unit growth in Benton County showed the greatest growth (55.1%) over any of the other analysis area counties. Conway and Searcy Counties showed the least growth with 12.7 and 14.8 percent, respectively (see Appendix B).

Housing vacancy rates have decreased marginally for the Ozark NF boundary counties in the last 10 years. The analysis area had rates similar to that of Arkansas in 1990. In 2000, the rate differential between forests and state was only 0.3 percent. Meanwhile, vacancy rates have increased by about two percentage points to 11.1 percent in 2000 for the St. Francis NF counties. Therefore, both Forests have vacancies on par with the State.

For 2000, housing vacancy was especially large in Van Buren, Newton, and Searcy Counties with rates of 25.5, 18.9, and 17.9 percent, respectively. Many of the boundary counties had rates in 2000 that were slightly greater than 1990 (see Appendix B).

Table 3-209: Housing Units

Area	Housing Unit % Change 1990-2000	% Vacant Units 1990	% Vacant Units 2000
Ozark NF Counties	32.5	11.0	10.8
St. Francis NF Counties	3.4	8.8	11.1
Arkansas	17.2	10.9	11.1

Source: U.S. Census Bureau from USDA NRIS HD Model

Median housing value is contrasted in the Table 3-210. Housing values within the OSFNFs analysis area tend to be substantially below that of Arkansas. Housing values are determined principally by the extent of demand. Greater the demand leads to higher prices. Population and job increases play a factor in the extent of demand for housing. Population began to increase at a significant rate in the 1990s. Population grew at a small pace during the prior decade. Housing stock increased at a significant rate in the 1990s in the Ozark NF boundary counties.

The St. Francis NF analysis area showed a decline in housing units in the 1990s. However, value is still low compared with the state, which has the influence of urban areas and can support higher priced housing. At any rate, it appears that the Ozark NF analysis area is dynamic as far as new home additions, slightly exceeding the growth rate of the state. The St. Francis area, however, is stagnant. Population and wage and salary growth will have to increase significantly to warrant significant increases in housing values.

Table 3-210: Housing Value

Area	1990 Median Value	2000 Median Value	Real Avg. Rate of Change 1990-2000*
Ozark NF Counties	$41,513	$66,438	1.95%
St. Francis NF Counties	$34,150	$44,850	-0.05%
Arkansas	$46,000	$72,800	1.83%

Source: U.S. Census Bureau from USDA NRIS HD Model.
***Real rates of increase were determined by inflating 1990 housing prices to 2000 with the Consumer Price Index Deflator.**

Appendix B illustrates the median housing values of all counties in the OSFNFs analysis area. Benton, Baxter, and Washington Counties have median values that significantly exceed those of the analysis area and the state. The prosperity of these counties is being driven by the economic commerce of Fayetteville and northwest Arkansas, which has the University of Arkansas and the world headquarters of Wal-Mart. Lee and Phillips Counties in the St. Francis boundary area are significantly lower then the state due to their more isolated and impoverished characteristics.

Economy's Diversity

Analyzing the major sectors of an economy allows insight into its diversity. It can show what industries may be driving its growth. Appendix B, which displays employment, labor income, and industrial output, shows the entire economy broken out by major Standard Industrial Code (SIC) and by important industry sub-sectors for wood products. There is also an estimate of wild land recreation developed in a Forest Service publication (Technical Advice Bulletin TAB-05032004), which provides an estimate of labor income from recreation activities for both federal and non-federal sources in each county. Appendix B shows the nine major one-digit SICs in bold print.

Table 3-211 shows the manufacturing sector, the sub-sectors for wood-based industries, and an estimate of the wildland recreation industry for percentage of industry labor income and employment for 1990 and 2000. Recreation is not a sector of an economy but comprises several of the services and retail industries.

Table 3-211: Economic Diversity

Industry	1990 Employment % Of Total Economy	2000 Employment % Of Total Economy	% Average Annual Change '90-'00	1990 Labor Income % Of Total Economy	2000 Labor Income % Of Total Economy	% Real Average Annual Change '90-'00
Manufacturing	23.8	18.4	1.4	28.1	21.6	1.8
Lumber/Wood Products	1.1	1.0	3.0	1.0	0.9	4.0
Wood Furniture & Fixtures	0.4	0.1	0.0	0.4	0.1	10.4
Paper & Pulp Products	0.2	0.2	NM	0.4	0.4	0
Total Wood Products	1.8	1.3	1.0	1.8	1.5	2.4
Wildland Recreation	NA	NA	NA	NA	1.4	NA
Total Economy*	242,973	354,640	3.9	**$6,290	**$9,773	4.5

Source: IMPLAN 1990 and 2000 Data; in millions of 2000 dollars.
***Real rates of dollar change were determined by inflating 1990 to 2000 with the Gross National Product Price Index Deflator.**
****Represents dollar totals for category**
NA = Not Available

From Table 3-211, it is evident that the economy in the OSFNFs area is becoming slightly less reliant on the manufacturing sector (it is becoming more diverse). From 1990-2000, manufacturing's importance declined by more than 6 percent of the share of labor income. Still, manufacturing is a relatively large proportion of the local economy's labor income, representing almost 22 percent of the economy in 2000.

Of the wood-manufacturing sector, total wood products maintained only a 1.5 percent share of the local economy's labor income in 2000. This is a similar share as it had in 1990 (1.3%). Employment's share diminished from a 1.8 percent share in 1990 to 1.3 percent share in 2000. Wood products represent a very small share of this economy.

Wildland recreation, which includes federal and state recreation areas, had an estimated 1.4 percent share of the total labor income of the OSFNFs economies in 2000. There are no estimates of employment for recreation.

Appendix B compares the OSFNFs analysis area's economy for 1990 and 2000 for all 9 major sectors of the economy. The overall composition of the analysis area economy has not changed greatly from 1990. Services, as measured by employment, increased from 18.5 to a 22.5 percent share in 2000 (a 5.9% annual increase). Other large

sector share changes include wholesale and retail sales' employment change of 5.1 percent per year, and government whose share decreased from 12.1 percent to 11.3 percent over the decade, but still managed employment gain of 3.1 percent per year. Even though employment share decreased and overall employment increased, this increase was made possible by the faster growth of the entire local economy (3.9% per year). The entire economy's labor income grew at a real average annual rate of 4.5 percent over the 1990 decade (based in constant 2000 dollars). Real labor income growth did not match the vigorous employment growth of the decade.

Thus, the local economy has changed little in the last 10 years. The economy's main drivers are manufacturing and services. Table 3-212 shows the average annual growth rate in employment and labor income through the 1990s decade.

Table 3-212: Economy Dynamics

Area	Employment Average Annual Change 1990-2000	Labor Income Real Average Annual Change 1990-2000
Forest Boundary Counties	3.9%	4.5%

Source: IMPLAN 1990 and 2000 Data

Both employment and constant 2000 dollars labor income have grown similarly over the decade at an average annual rate of 3.9 versus 4.5 percent, respectively.

Another way to indicate diversity of an economy is with the Shannon-Weaver Entropy Indexes of Diversity. This process allows a relative measure of how diverse a county is with a single number. The entropy method measures diversity of a region against a uniform distribution of employment where the norm is equal-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 0 and 1.0. Another factor affecting the magnitude of the index is the number of industries in a local economy (the greater the number the larger the index).

Table 3-213 contrasts the change in diversity from 1990-2000 at the four-digit SIC (the individual industry level). For a point of reference, Arkansas serves as comparison guide. Appendix B illustrates the indexes for all counties in the OSFNFs analysis area.

Table 3-213: Shannon-Weaver Entropy Index.

Area	1990 Index	2000 Index	Percent Change
Forest Boundary Counties*	.63257	.64266	1.6
Arkansas	.74039	.73581	-0.6

***Weighted Average Estimate of Aggregated Counties. Weighted by full-time and part-time employment in their respective years. Source: USDA Forest Service, Information Monitoring Institute.**

The index measuring diversity actually indicated slightly more diversity in the Forests' analysis area but less in Arkansas during the 1990s. The areas around the Forests became 1.6 percent more diverse while Arkansas became 0.6 percent less diverse. Yell County had the greatest increase in diversity during the 1990s, about a 9 percent change. Meanwhile, Newton County had the greatest decrease of 2.6 percent during the decade.

As indicated in Table 3-213, the overall change of the OSFNFs' cumulative economy over the 1990 decade was marginal. This is substantiated by these diversity indexes, which changed very little.

Economy's Trade

A principle way an economy grows is by export of 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 in travel-related activities to bring in new dollars. A manufacturing industry can be a net importer if it imports more of a commodity than it exports.

Table 3-214 compares the exporting characteristics of the OSFNFs analysis area for 1990 and 2000.

Table 3-214: Exporting of Selected Industries

Industry Products	1990 Net Exports*	2000 Net Exports
Lumber & Wood Products	$49	$96
Wood Furniture & Fixtures	$16	$-41.9
Paper & Pulp Products	$-86	$-82
Total Wood Products	$-21.4	$-27.9
Total Manufacturing	$1,650	$1,345
Total of All Sectors	$52	$-1,555

***1990 Dollars Converted to 2000 Dollars via GDP Price Deflator, in millions of dollars.**
Source: IMPLAN 1990 and 2000 Data

Table 3-214 illustrates that the OSFNFs' local economy went from a net exporting economy in 1990 to a net importing economy in 2000. The comparison of the net exports to the net imports resulted in the negative figures shown in Table 3-214. The 1990s saw the total economy's reliance on imports increase tremendously, thereby becoming more reliant on other areas for its goods and services production. Wood products, meanwhile, only showed large changes in the wood furniture and fixtures industry, going from a net exporting economy to an importing economy. Lumber and wood products nearly doubled their exporting share, while pulp and paper decreased their net importing slightly. Total manufacturing lost slightly in net exporting by about 18 percent in the 1990s. Finance, insurance, real estate, and services were sectors

that showed the greatest change in net imports over the 1990s. The only positive exporting sectors occurred in manufacturing, construction, transportation, and utilities, wholesale, and retail trade (see Appendix B).

In summary, the Ozark-St. Francis NF area economy became more reliant on imports during the 1990s. More dollars, therefore, flowed out of the economy than flowed in, reducing the ability of enhancement of further economic activity through the multiplier effect.

Federal Payments

Payments in Lieu of Taxes (PILT) are funds that the federal government transfers to counties to help offset the non-tax status of federal lands within their boundaries. PILT is a payment from the Bureau of Land Management that covers shortfalls from natural resource consumption on the national forests. That is, if the Forest Service's "25% Payments" from timber harvesting, mining, and recreation do not cover at least $1.75 per acre, PILT will make up the shortfall.

Trends in "25% Payments" and PILT are important to show a possible erosion of an area's tax base. Appendix B breaks out revenues for each of the 18 forest counties. Table 3-215 shows the aggregated forest county changes from various years for data that was common between the two sources (all data has been updated to 2000 dollars).

Table 3-215: "25% Payments" in Thousands of 2000 Dollars

Area	1985 (2000 $'s)*	1998 (2000 $'s)*	Real Average Annual Change
Ozark NF Counties	$2,206	$2,874	0.02%
St. Francis NF Counties	$72.1	$5.1	-15.0%
Arkansas	$4,980	$8,140	3.9%

***Data adjusted to 2000 Dollars via Gross Domestic Price Deflator**
Source: USDA Forest Service

County revenues from the FS have been variable since 1985, the first year of available data for "25% Payments" (see Appendix B). Even with the year-to-year variability, OSFNFs Payments to Counties (adjusted to 2000 dollars) have only grown by an average 0.2 percent real rate per year since 1985. St. Francis NF Payments to Counties have decreased by an average 15 percent per year on a real rate basis since 1985. Inflation during the 1985 to 1998 period averaged 2.7 percent per year as measured by the Gross Domestic Price Deflator.

Since 1998 Crawford, Johnson, Logan, Pope, Stone, and Yell Counties have chosen to be compensated via the Secure Roads and School Act, which gives them payments based on an average of 1986-1999. Their payments will be more stable than the remaining counties, which have chosen to remain under the traditional method of payment of 25 percent of Forest Service receipts.

Most counties have experienced a growth in funds that was above the Forests average. Notable exceptions are Lee and Phillips Counties on the St. Francis NF, which had significant decreases of about 15 percent per year.

At the same time, PILT funds have trended up to help offset the large number of acres federally owned in these counties. While the magnitude of PILT payments is much smaller than "25% Funds," PILT payments have tended to increase over time as timber harvests have decreased on the OSFNFs. Inflation adjusted payments in the 18-county Ozark-St. Francis analysis area have grown from $802,219 in 1991 to $1,582,597 in 2002, a 7.3 percent average annual increase (Table 3-216). This rate of increase is slightly less than the rate of increase for all counties in Arkansas over this length of time (see Appendix B). In 1998 on the OSFNFs, PILT, which substitutes for property taxes, made up about 93 percent of government payments.

Table 3-216: PILT Payments in Thousands of 2000 Dollars

Area	1991 (2000 $'s)*	2001 (2000 $'s)*	Real Average Annual Change
Ozark NF Counties	$802.2	$1,582.6	7.30%
St. Francis NF Counties	$2.7	$8.4	12.06%
Arkansas	$1,177.7	$2,723.4	8.70%

***Data adjusted to 2000 Dollars via Gross Domestic Price Deflator**
Source: U.S. Dept. of Interior

Summary of Demographic and Economy Changes

Population and economic dynamics are changing at different rates within the OSFNFs analysis area. While population grew very slowly from 1980-1990, growth has seemed to increase substantially during the 1990s. The rate of increase on the Ozark NF has been 31.6 percent over this period, about 18 percentage points ahead of the growth rate of the state. Increased population suggests the area may have new residents from outside the area, which will present non-traditional ideas from those of long-standing residents possibly those that are non-commodity based. However, the St. Francis NF has seen a population decrease of about 6.8 percent.

Minority population's share has changed significantly within the analysis area from 1980-2000. Minority share has increased about 6 percent from 3.4 percent to 9.3 percent on the Ozark NF, and about 3 percentage points on the St. Francis NF to 60 percent over this time period, indicating significant growth. While these numbers for the Ozark NF are still less than the share found in the state in 2000 (20%), the share on the St. Francis NF is over 60 percent minority, much greater-than the state's share. This increase on the St. Francis in conjunction with population decreases may be from non-minorities moving out of the area. This growth in minority population provides increased opportunities for minority participation in local recreation endeavors.

The analysis area's rural-urban characteristic decreased by about two percentage points to 60.3 percent on the Ozark NF from 1980-1990, while on the St. Francis NF the rural share increased from 48 to 54 percent over the same time period.

Population density increased significantly in the Ozark NF analysis area indicating migration to this area for vacation homes, and increased commerce in northwest Arkansas near the urban Fayetteville area. The St. Francis area lost density indicating an outflow of population.

The Ozark NF economic health as measured by per capita income grew at a modest rate during the 1990s (a 2.0% average annual rate over the 10-year period) equal to that of Arkansas' rate. Still, per capita income in 2000 was only about $100 less than that of the State's. The St. Francis NF growth was even greater (increasing almost 3% per year over the decade). It is worth noting that the St. Francis NF per capita income was significantly less then the state average ($11,867 compared to $16,904) in the year 2000.

The unemployment rate of the Ozark NF boundary counties remained even at 3.9 percent from 1995-2001. The rate in 2001 was less than the state rate of 5.1 percent. Income growth rate in this area has progressed steadily, indicating that the area is relatively economically strong. People with strong incomes and jobs are more likely to have free time and need an outlet for recreation. The national forest is a prime outlet for these people. The St. Francis analysis area had an unemployment rate (9.9%) almost twice the state rate in 2001. That rate only has decreased marginally since 1995.

Both Forests' poverty rates have declined over the period from 1980-2000, nearly 3-percentage points for the Ozark, and 10-percentage points for the St. Francis analysis areas. Meanwhile, Arkansas' rate has decreased by 3 percent over the same time period to 16 percent. Benton County's 10 percent poverty rate and a large population component in 2000 played a part in the favorable OSFNFs county poverty rate versus that of the State.

From 1970-2000, transfer payments in the Ozark NF analysis area showed about a 1 percent greater average annual real rate of growth than that of the State (4.9 vs. 4.2%). The St. Francis analysis area showed a slower growth in transfer payments (2.3% vs. the State's 4.2%). The Ozark's larger transfer payment growth gives the local economy added economic support.

Percentage of female head of households was greater than the state percentage in both analysis areas. The Ozark NF was almost 2 percent above the State's 7.4 percent of all households, and the St. Francis was about 17 percent higher, a condition that indicates a great degree of hardship.

Housing unit growth was much greater in the Ozark area than the State for the 1990s, a sign of relative prosperity. Median housing value in 2000 was about $6,400 less than the state average of $72,800, a condition that can be expected with a larger urban component that tends to be associated with more demand for housing and thus

higher prices. In 2000, average housing prices in the St. Francis analysis area were about $27,900 less than the average housing prices of the state.

The OSFNFs analysis area's economy has become less reliant on the manufacturing sector. As measured by labor income, manufacturing produced about 22 percent of the salaries and wages in this economy during 2000. During the 1990s, the economy did not change drastically. Manufacturing had a change from a 28 percent to a 22 percent share of labor income. Sectors with substantial increase in share over the decade were wholesale trade, retail trade, and government. Wood products manufacturing in 2000 held about a 1.5 percent share of the labor income share of the total OSFNFs economy, down from about a 1.8 percent share in 1990.

The Shannon-Weaver Entropy indexes show that the Ozark-St. Francis analysis area has grown slightly more diversified overall since 1990. This would be expected in an expanding economy.

Since 1990, the area has changed from a marginally net exporting regional economy with $52 million (in 2000 dollars) in net exports to a significant importing area with 1.55 billion in net imports in 2000. Because an economy grows with industries that produce for export, the Ozark-St. Francis area must send its dollars outside the area to purchase goods and services for its economic consumption. Preferably, an economy would rather attract new money via exports so that money can remain in the area to turn over in additional economic transactions before it leaks out. Economies that export more than they import are able to grow faster than those that are net importers.

Wood based industries have increased their imports over the decade from $21.4 million to $27.9 million in 2000. Other than manufacturing, the only other major sectors in this economy to be net exporters are construction, range, transportation, utilities, and wholesale and retail trade.

PILT payments grew 7 percent a year in the Ozark area and 12 percent in the St. Francis area from 1991-2002. Payments to Counties grew much slower, less than 1 percent per year in the Ozark area and 15 percent per year in the St. Francis area.

Thus, the economy and demography of this area appear to be healthy for the Ozark analysis area and very much less healthy for the St. Francis analysis area, which is more isolated from commerce, tourist areas, and urban areas than the Ozark. For the Ozark, population grew steadily in the 1990s, and poverty was at a relatively low level. Housing construction was vigorous. The economy's composition has changed only marginally in the last decade. It has become more reliant on importation of goods and services, rather than production of its own goods and services for export. A diverse economy has resilient characteristics to recessions that allow it to weather downturns in the economy. For the Ozark NF analysis area, most of the economic and demographic variables looked at in this overview were comparable with those of Arkansas. Social and economic characteristics seem to be on par with the State.

Values, Attitudes, and Beliefs

During forest planning, it is important to ask the public how they perceive national forest management; how they would like to see the national forests managed; and how they would resolve natural resource issues that often represent different ideals to different groups. (A complete text of this survey can be found in Appendix B.)

The Ouachita and Ozark-St. Francis National Forests commissioned the USFS Southern Research station to conduct a values, attitudes, and beliefs random telephone survey of populations within 150 miles of the center of the Ozark and Ouachita National Forests and within 50 miles of the St. Francis National Forest to learn of the public's general feelings for these issues. In conducting a random telephone survey, we are able to learn what the so-called "silent majority", those who may not attend forest public involvement meetings, are thinking.

Below is a general synopsis of the findings of the nearly 800 telephone calls made over 207 counties in the sample database. Appendix B contains the complete survey results. Summary results are tabulated in the analysis that follows.

Over 97 percent of the respondents were year-round residents in their respective county; approximately 21 percent of the respondents were from Texas and 20 percent from Arkansas. Of the entire sample population, 65 percent had lived in the county of residence their entire life. Of the telephone survey respondents, 25 percent had visited the Ouachita NF, and 26 percent the OSFNFs. Of those who had visited either of these national forests, 51 percent had visited the Ozark-St. Francis NF and 45 percent had visited the Ouachita NF.

The survey had 51 percent female respondents; 76 percent white (16% black); 74 percent high school education or higher; 30 percent with only a high school education; 19 percent college educated; 57 percent employed; 39 percent retired; 35 percent with incomes in the $25,000-74,999 range; 38 percent ages 16-34; and 34 percent ages 35 to 54.

Twenty-four percent moved to the area because family or friends were in the area; 22 percent had moved when they were young; and 19 percent moved to the area because of their jobs.

Table 3-217 presents a "yes" response as to whether the surveyed person participates in given recreation activities:

Table 3-217: Survey of Persons Participating in Recreation Activities.

Activity	Percent Responding "Yes"
Mountain Biking	17%
Horseback Riding on Trails	14%
Day Hiking	27%
Backpacking	7%
Developed Camping	25%
Visit a Wilderness	39%
Gather Mushrooms, Berries	32%
Nature Viewing/Photography	56%
Big Game Hunting	14%
Small Game or Waterfowl Hunting	14%
Driving for Pleasure	70%
Off-Road Vehicle Driving	27%
Freshwater Fishing	37%
Canoeing or Kayaking	12%
Rafting	19%
Rock Climbing	5%

Quite clearly, most people participate in the outdoors in their car through driving for pleasure; nature viewing was the second most predominant; visiting a wilderness area was third.

Table 3-218 indicates "Extremely Important" and "Important" beliefs of respondents for certain forest management objectives of the Forest Service:

Table 3-218: Importance of Forest Management Objectives

Forest Management Activity	% Extremely Important	% Important
Maintaining Stream Quality	86%	6%
Providing Outdoor Recreation	46%	24%
Providing Habitat for Fish & Wildlife	71%	14%
Providing Quiet Places for Renewal	53%	19%
Leave Forest in Natural Appearance	63%	18%
Emphasizing Planting Trees for Timber	59%	18%
Provide Access to Raw Materials	30%	22%
Protect Endangered Plants & Animals	62%	16%
Emphasize Managing Trees for Healthy Forests	70%	16%

Providing healthy forests and emphasizing healthy habitats through active forest management appear to be the most important management objectives of the overall public.

Next, the public was asked questions about their perceived choices for forest management on public lands. Results indicating "Very Important" or "Important" are listed in Table 3-219.

Table 3-219: Perceived Choices for Forest Management on Public Lands.

Management Activity	Very Important	Important
Restrict Access for Motorized OHV	33%	20%
Develop & Maintain Trail System	34%	29%
Provide Challenging Motorized Trails	20%	16%
Develop New Paved Roads	20%	12%
Develop Primitive-Only Backcountry Areas	41%	22%
Use Control Fires to Restore Natural Conditions	36%	27%
Protect Areas that are Sources of Water	80%	10%
Manage Forests for Historical Ecosystems	46%	22%
Manage Forests to Maintain Today's Conditions	58%	24%
Protect Important Wildlife Habitats	67%	17%
Restrict Harvesting & Mining	24%	19%
Expand Commercial Recreation Services	21%	17%
Introduce Recreation Fees	35%	27%
Introduce a Rec. Fee for OHV to Maintain Trails	30%	18%
Increase Law Enforcement	50%	16%
Create Open Areas in the National Forest	43%	26%
Manage Forests to Increase Wildlife Populations	36%	19%
Protect Older or Continuous Forest Areas	63%	20%
Limit Number of People on Rivers at One Time	28%	18%
Use Controlled Fires to Reduce Threat of Wildfires	52%	22%

Again the largest share of the public's wishes dealt with forest management objectives that preserve habitat, old growth, sources of water, and prevent wildfires.

The public was asked questions dealing with environmental attitudes. Their feelings on these subjects are captured with "Strongly Agree" or "Somewhat Agree." Table 3-220 illustrates their responses.

Table 3-220: Environment Attitudes of Respondents.

Attitude	Strongly Agree	Somewhat Agree
Environmental Species Act Strengthened	30%	31%
Protect Streams for Recreation	22%	28%
More Controls on Tourism & 2nd Homes	34%	33%
U.S. Should Rely on Imported Wood Products	13%	25%
There are No Reasons to Cut National Forest Trees	31%	17%
Trained Professionals should Manage Public Lands	48%	30%

The majority of responses with both "Strongly Agree" and "Somewhat Agree" were tabulated for ESA strengthening, professionals managing the public lands, and control on tourism and second home development.

Our survey of area publics indicates that people lean fairly strongly to environmental conservation. While extraction of natural resources is not completely discounted by the public, preservation and provision of wildlife and recreation services are desired for the most part.

Direct and Indirect Effects

Economic impacts of each proposed alternative are given in the tables below. Alternatives are measured against the current or historical situation over the past 10 years. Alternative A differs from "Current" only by the timber resource output estimates. Table 3-221 illustrates how the proposed alternatives differ from the current management direction by jobs. Due to substitution effects from competing non-government sources (such as similar volume of timber harvesting that may occur on private lands if NF timber is not offered to the market), these jobs are characterized as being associated with local economic activity initiated by FS programs and activities rather than caused by these activities. Alternatives B through E transition from less human influence to more emphasis on human intervention and provide more multiple-use of forest resources.

Employment changes from the current situation include for Alternative A an increase of 14.6 percent, for Alternative B an increase of 10.5 percent, for Alternative C an increase of 12.7 percent, for Alternative D an increase of 15.4 percent, and for Alternative E (preferred alternative) an increase of 11.4 percent. Alternative D has the highest level of job increases, with an increase of 15.4 percent. Jobs vary from a low of 3,508 for Alternative A (current direction) to a maximum of 4,049 under Alternative D.

Recreation, timber, and FS expenditures are the programs that are associated most with jobs provided in this economy; this relationship holds for all alternatives. Those alternatives with a timber emphasis contribute the third most to jobs of all FS programs, followed closely by wildlife and fish, Payments to States and Counties (jobs created through these payments), and then minerals.

Table 3-221: Employment by Program by Alternative (Average Annual, Decade 1).

Employment	Alternatives					
	Current	A	B	C	D	E
Total Number of Jobs Contributed by Resource						
Recreation	2,060	2,060	2,163	2,115	2,092	2,115
Wildlife and Fish	449	449	462	459	453	459
Grazing	2	2	2	2	2	2
Timber	435	888	661	744	838	712
Minerals	38	38	38	38	38	38
Payments and Expenditures						
Payments to States/Counties	42	74	58	70	67	64
Forest Service Expenditures	481	507	493	527	559	518
Forest Management						
Total Forest Management	3,508	4,020	3,877	3,954	4,049	3,909
Percent Change from Current		14.6%	10.5%	12.7%	15.4%	11.4%

***Payments to States and Counties are the number of jobs created from the "25% Payment."**

Table 3-222: Labor Income by Program by Alternative (Average Annual, Decade 1; $1,000,000).

Labor Income	Alternatives					
	Current	A	B	C	D	E
Income by Resource (In millions of Dollars)						
Recreation	$40.5	$40.5	$42.5	$41.6	$41.2	$41.6
Wildlife and Fish	$8.9	$8.9	$9.2	$9.1	$9.0	$9.1
Grazing	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Timber	$15.4	$31.6	$23.5	$26.4	$29.7	$25.3
Minerals	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2
Payments and Expenditures (In millions of Dollars)						
Payments to States/Counties	$1.4	$2.5	$2.0	$2.4	$2.3	$2.2
Forest Service Expenditures	$14.1	$16.3	$15.0	$17.2	$18.6	$16.7
Forest Management						
Total Forest Management	$82.8	$102.3	$94.7	$99.2	$103.2	$97.4
Percent Change from Current		23.5%	14.3%	19.7%	24.6%	17.5%

Labor income by alternative is given in Table 3-222. The current alternative has $82.8 million of labor income associated with it. The range of labor income in the other alternatives is $102.3 million for Alternative A to $97.4 million for Alternative E. The percent changes in income from current direction are increases of 23.5 percent and 24.6 percent for Alternatives A and D, and increases of 14.3 percent and 12.7 percent for Alternatives B and C, and 17.5 percent for the preferred Alternative E. Recreation and those alternatives with a wildlife and significant timber program contribute most income to the forest total. The Minerals Program is constant across all alternatives.

Employment and income found in Tables 3-221 and 3-222 are divided into the major sectors of the OSFNFs economy in Tables 3-223 and 3-224. For all alternatives, agriculture, administration, waste management, and government are the sectors most affected by FS programs and expenditures. To the extent that an alternative has a commodity program, manufacturing is also affected to a significant degree. Labor income in the form of wages and proprietors' earnings has a similar effect as employment on the retail trade, services, and government sectors of this economy.

Table 3-223: Employment by Major Industry by Alternative (Average Annual, Decade 1)

Employment	Alternatives					
	Current	A	B	C	D	E
Employment by Major Industry (Jobs)						
Agriculture	313	599	465	522	564	497
Mining	32	32	32	32	32	32
Utilities	7	8	8	8	8	8
Construction	24	31	27	30	30	29
Manufacturing	213	316	262	274	310	271
Wholesale Trade	26	38	32	35	37	34
Transportation & Warehousing	37	46	42	44	46	43
Retail Trade	66	79	74	80	84	78
Information	59	60	62	61	61	61
Finance & Insurance	19	24	22	23	24	23
Real Estate & Rental & Leasing	45	49	49	49	50	49
Prof, Scientific, & Tech Services	213	225	227	230	233	228
Management of Companies	45	47	48	48	48	48
Admin, Waste Mgmt	1,315	1,319	1,377	1,353	1,337	1,352
Educational Services	315	316	330	322	321	322
Health Care & Social Assistance	36	42	40	42	44	41
Arts, Entertainment, and Rec	50	51	52	52	52	52
Accommodation & Food Services	51	59	56	59	62	58
Other Services	281	291	298	296	295	295
Government	362	387	374	393	409	386
Forest Management						
Total Forest Management	3,508	4,020	3,877	3,954	4,049	3,909
Percent Change from Current		14.6%	10.5%	12.7%	15.4%	11.4%

Table 3-224: Labor Income by Major Industry by Alternative (Average Annual, Decade 1 in Millions of Dollars).

Labor Income	Alternatives					
	Current	A	B	C	D	E
Labor Income by Major Industry (In Millions of Dollars)						
Agriculture	$10.0	$20.2	$15.4	$17.5	$19.0	$16.6
Mining	$2.1	$2.1	$2.1	$2.1	$2.1	$2.1
Utilities	$0.5	$0.7	$0.6	$0.6	$0.7	$0.6
Construction	$0.7	$0.9	$0.8	$0.9	$0.9	$0.9
Manufacturing	$6.9	$10.6	$8.7	$9.1	$10.4	$9.0
Wholesale Trade	$1.5	$2.1	$1.8	$1.9	$2.1	$1.9
Transportation & Warehousing	$1.5	$1.8	$1.7	$1.8	$1.9	$1.7
Retail Trade	$1.3	$1.5	$1.4	$1.5	$1.6	$1.5
Information	$2.4	$2.4	$2.5	$2.5	$2.5	$2.5
Finance & Insurance	$0.8	$0.9	$0.9	$0.9	$1.0	$0.9
Real Estate & Rental & Leasing	$1.0	$1.0	$1.0	$1.0	$1.1	$1.0
Prof, Scientific, & Tech Services	$5.8	$6.1	$6.2	$6.2	$6.3	$6.2
Management of Companies	$3.4	$3.6	$3.7	$3.6	$3.6	$3.6
Admin, Waste Mgmt & Rem Serv	$18.7	$18.8	$19.6	$19.3	$19.1	$19.3
Educational Services	$4.9	$4.9	$5.1	$5.0	$5.0	$5.0
Health Care & Social Assistance	$1.3	$1.6	$1.5	$1.6	$1.7	$1.5
Arts, Entertainment, and Rec	$1.2	$1.2	$1.2	$1.2	$1.2	$1.2
Accommodation & Food Services	$0.7	$0.8	$0.7	$0.8	$0.8	$0.7
Other Services	$6.7	$6.9	$7.1	$7.1	$7.0	$7.0
Government	$11.6	$14.0	$12.7	$14.6	$15.5	$14.0
Forest Management						
Total Forest Management	$82.9	$102.4	$94.7	$99.2	$103.2	$97.4
Percent Change from Current		23.5%	14.3%	19.7%	24.6%	17.5%

Forest Service revenues from program activities, which result in payments to states and counties, are expected to decrease from the current direction for all Alternatives except Alternative A. This is because of the larger timber revenues in the alternatives that increase payments to counties. The magnitude of payments to counties expected in the first decade is shown in Table 3-225. Current management is a payment of $2.1 million, while Alternative A shows a $3.7 million payment; Alternative B would be expected to show a $2.9 million payment; Alternatives C and D, $3.5 and $3.4 million payments, and Alternative E, a $3.2 million payment to the counties within the OSFNFs boundaries.

Table 3-225: Forest Service Revenues and Payments to Counties (Annual Average, Decade 1; $1,000,000)

Forest Service Payments and Revenues	Alternatives					
	Current	A	B	C	D	E
Revenue (In Millions of Dollars)						
All Program Revenues	$21.7	$22.0	$18.5	$20.0	$21.0	$19.4
Payments (In Millions of Dollars)						
Payments to States and Counties	$2.1	$3.7	$2.9	$3.5	$3.4	$3.2
Percent Change from Current		76.2%	38.1%	66.7%	61.9%	52.4%

Finally, Table 3-226 illustrates the percentage contribution of the current management program to the area's economy. Currently, the OSFNFs are associated with 1.0 percent of the total local economy's jobs, and 0.8 percent of the labor income. Manufacturing, retail trade, health care, and government are the sectors of the economy that show the most benefit from the forests' activities.

Table 3-226: Current Role of FS-Related Contributions to the Area Economy.

Industry	Employment (Jobs)		Labor Income ($ Million)	
	Area Totals	FS-Related	Area Totals	FS-Related
Agriculture	15,466	313	$240.0	$10.0
Mining	652	32	$30.3	$2.1
Utilities	2,314	7	$177.9	$0.5
Construction	21,813	24	$626.7	$0.7
Manufacturing	60,017	213	$2,151.6	$6.9
Wholesale Trade	9,213	26	$486.6	$1.5
Transportation & Warehousing	28,598	37	$1,047.3	$1.5
Retail Trade	37,689	66	$732.5	$1.3
Information	3,460	59	$155.6	$2.4
Finance & Insurance	9,096	19	$330.5	$0.8
Real Estate & Rental & Leasing	8,139	45	$139.1	$1.0
Prof, Scientific, & Tech Services	11,003	213	$380.7	$5.8
Mgt of Companies	14,666	45	$1,066.0	$3.4
Admin, Waste Mgt	12,807	1,315	$223.5	$18.7
Educational Services	3,430	315	$57.5	$4.9
Health Care & Social Assistance	27,337	36	$911.0	$1.3
Arts, Entertainment, and Rec	3,083	50	$58.3	$1.2
Accommodation & Food Services	22,041	51	$267.6	$0.7
Other Services	19,658	281	$298.8	$6.7
Government	35,593	362	$1,302.4	$11.6
Total	346,074	3,508	$10,683.9	$82.9
Percent of Total	100.0%	1.0%	100.0%	0.8%

Economically speaking, commodity oriented alternatives have a greater roll in producing impacts on the economy. However, substitutions may occur in certain sectors, such as those related to the timber program, where non-government owners

could supply those processing facilities related to timber. Therefore, there would likely be no loss of jobs or income from a reduced federal timber program. Recreation plays a significant part in the forests' contributions to the local economy.

Social Impacts

During the forest planning process, numerous public meetings were held to allow 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 the issues, which helped develop the 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. During forest planning, it is desirable to ask the public how they perceive national forest management; how they would like to see the national forests managed; and what their opinions of natural resource issues are. These opinions are often contentious, which makes it or hard to please all groups.

The Ouachita and Ozark-St. Francis National Forests commissioned the USFS Southern Research Station to conduct a values, attitudes and beliefs (VAB) random telephone survey of populations within 150 miles of the center of the Ozark and Ouachita National Forests and within 50 miles of the St. Francis National Forest to learn of the public's general feeling for these issues. In conducting a random telephone survey, we are able to learn what the so-called "silent majority", those who may not attend forest public involvement meetings, are thinking. 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 "Values, Attitudes, and Beliefs of Population within the Ozark-St. Francis and Ouachita National Forests Commuting Area" report contained in the affected environment section above, and in Appendix B. Effects from our proposed land management alternatives on the public's preferences in land management follows below.

One of the ways people relate to the national forests is their recreational use of national forest lands. For more information on the types of recreational activities people are involved with on the national forest, and how this may change by alternative, see the section in this FEIS on Dispersed and Developed Recreation. This survey showed that over 70 percent of the respondents enjoyed driving for pleasure, followed by 56 percent who liked nature viewing and photography, and 39% who visited wilderness. The predominance of respondents' replies was favoring some sort of day-use activity. This corresponds to one of the recreational objectives in some of the alternatives in shifting the emphasis to those types of activities.

Alternative A continues with current management, which includes many of the preferred activities such as driving for pleasure. The alternative does not attempt to shift or provide an emphasis for more day use. Alternative B responds to some of the respondents' preferences by adding three additional scenic byways, a proposed wild and scenic river, and increasing day-use opportunities. Alternative B emphasizes recreational activities that provide benefits to tourism. However, with the large amount of custodial land in this alternative, some of the other opportunities would be less.

Alternative C adds the same wild and scenic river, plus quite a few acres of oak and pine woodland, which would be excellent nature viewing and photography areas. Day-use opportunities also increase in this alternative. Alternative D focuses mostly on balancing timber age classes, and is similar to alternative A in providing recreational opportunities. Alternative E is a mix of parts of all the alternatives providing the best mix in trying to meet what the respondents said was important to them. This alternative includes additional scenic byways, pine and woodland restoration areas, and increasing trail opportunities. This alternative focuses on the shift from traditional developed recreation, to more day use.

The public survey provided some information on the values residents have relating to natural resources or forest management objectives. About 86 percent of the sample in the OSFNFs market area thought protection of clean water was an extremely important management goal for national forests. The next highest percentage (71%) was providing habitat for fish and wildlife, followed by managing trees for a healthy forest (70%) for future generations, natural appearing forests (63%), protection of rare or endangered species (62%), and planting trees for timber (59%).

People who reside in the areas near the OSFNFs put wildlife, ecosystems, and naturalness slightly above utilitarian objectives in the management of these national forests.

Respondents were asked about possible management objectives of the Forests. The following analysis provides a comparison of the most favored management objectives versus the range of alternatives available to forest decision makers.

The range in forest planning alternatives from the alternative that provides more management activities and provisions of multiple use to the alternative that provides fewer of these management activities is as follows:

- More Management Activities to Fewer Management Activities
    - Alternative D A B E C Current

Approximately 86 percent of local residents favored a management objective that would maintain stream quality.

All alternatives call for water quality and riparian areas to be protected through Arkansas' BMPs. By applying these BMPs, there is virtually no difference in the alternatives concerning effects on water quality.

A large part of the local population likes hunting on the OSFNFs; therefore, management of the Forests for wildlife is important to them. About 71 percent of respondents wanted the Forests to be managed for wildlife by providing habitat. All alternatives continue to provide high quality wildlife habitat. Alternatives A and D will provide habitat through traditional timber management practices by attempting to balance age classes. They would provide habitat for wildlife demand species (huntable wildlife) through a more managed forest.

Alternative B emphasizes providing habitat with the addition of high quality timber management prescription areas, and a high quality wildlife management area aimed primarily at providing elk habitat. This alternative would provide habitat for wildlife demand species (huntable wildlife) through a more managed forest similar to Alternatives A and D. Alternative C provides pine and oak woodland management prescription areas, and mixed forest management prescription areas. Habitat for wildlife, both demand species and non-consumptive, would be provided in a mixture of these areas. Alternative E provides habitat for wildlife, both demand species and non-consumptive, by adding a mixture of management prescription areas. This alternative provides the best mix of different wildlife opportunities of all the proposed alternatives.

Timber management has been a very important part of the local economic and social structure throughout the history of the OSFNFs. Approximately 70 percent wanted management direction to emphasize managing trees for a healthy forest; and 59 percent wanted to see trees planted for timber. All alternatives attempt to provide wood products and manage for healthy forests in different ways. Alternatives A, B, and D use more traditional timber management practices by balancing age classes. Alternatives B and D provide the most volume of timber (see Chapter 2, Comparison of Alternatives, Issue 5, Communities and Economies). All alternatives use different levels of prescribed fire as one of the tools to manage forest health. Alternatives C and E use the most fires, followed by Alternatives D, B, and A.

Finally, approximately 63 percent want to see the Forests left in a natural appearance or high quality scenery. Alternative A and 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. Alternative C provides high quality scenery in both natural and managed settings. Highways and roads in the Forests would have forest stands with few, if any, broken views. Alternative B would emphasize the natural processes in a natural landscape pattern in a large custodial management area. The high quality management areas would appear highly variable in tree sizes and openings and the canopy may be seen from roadways and vista points. Alternative E would provide both natural and managed settings similar to Alternative C. Highways and roads in the Forests would have forest stands with few, if any, broken views.

The value favored least by survey participants included management of national forests as sources of raw materials (30%). The OSFNFs provide very little in the way of raw materials. There are active natural gas fields on parts of the Forests. No alternative favors increasing or decreasing the availability of natural gas. There are no large mineral deposits, quarries, or other type of mining on the OSFNFs.

Cumulative Effects

Cumulative effects analysis is designed to reveal the context of alternative impacts within the planning area. 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 a 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 1969-2005. The analysis is made with employment and income estimates for each alternative remaining at 2005 levels.

The assumption made in our analysis is that the same rate of growth will continue over the 15 years of the forest plan. The source of the data for these estimates is the U.S. Bureau of Economic Analysis.

Table 3-227 shows employment and labor income for the planning area. The first two columns present the 2003 base year and that portion of the base year attributable to use and management of the national forest. The next column shows state and local government projections for 2018. Alternative outputs are assumed constant over the planning horizon. Included in the projections are employment and income effects attributed to the current direction ("no action") alternative. The remaining columns show the separate effects of each alternative at the end 2018.

Table 3-227: Current Cumulative Economic Impacts, Year 2003. (In Millions-2005 Dollars)

Projected Economic Impacts	2003		2018						
	Area	Forest	Area	Forest Portion					
					Alternatives				
	Totals	Portion	Totals	Current	A	B	C	D	E
Economic Indicators									
Employment									
Total (jobs)	311,065	3,508	502,040	3,508	4020	3877	3954	4049	3909
Area Totals %	100%	1.1%	100%	0.6%	0.8%	0.8%	0.8%	0.8%	0.8%
% of Change from Current	---	---	---	0%	15%	13%	13%	13%	13%
Labor Income									
Total ($ million)	$4,300.0	$82.9	$7,100.0	$82.8	$102.4	$94.7	$99.2	$103.2	$97.4
Area Totals %	100%	1.9%	100%	1.1%	1.4%	1.3%	1.4%	1.5%	1.4%
% of Change from Current	---	---	---	0%	24%	19%	21%	20%	19%

In 2003, the Forests accounted for 1.1 percent of all employment. In 2018 for the proposed alternatives in the FEIS, expected shares of the economy will be 0.8 percent of the economy for all alternatives.

Employment changes in 2018 from the current or "no action" alternative are 15 percent change in Alternative A; 13 percent change in Alternative B; 13 percent change in Alternative C; 13 percent change in Alternative D; and 13 percent change in Alternative E (preferred alternative).

In 2003, the Forests accounted for 1.9 percent of all labor income. If the Forests were to continue under current management, it is estimated that in 2018 they would

account for about 1.1 percent of all labor income. For the proposed alternatives in the FEIS, expected shares of the economy will range from 1.4 percent for Alternatives A, C, and E; 1.3 percent for Alternative B; and 1.5 percent for Alternative D.

Income changes in 2018 from the "no action" (current) alternative range from 24 percent change for Alternative A; 19 percent change for Alterative B; 21 percent change for Alterative C; 20 percent change for Alterative D; and 19 percent change for Alternative E (preferred alternative).

The cumulative effects analysis shows that over time the employment and income proportionate share of the economy will decrease with all alternatives because the local economy is expected to grow faster than the expected FS contribution to the economy.

Present Net Value of the Alternatives

Table 3-228 shows estimated benefits, costs, net benefits, and cumulative present net value (PNV) by alternative. All figures are in thousands of 2005 dollars. The benefits in Table 3-228 include market values and non-market estimated values. Market values include those values for which the Forest Service receives money such as minerals, timber, range, and special uses. Non-market values are estimated values for amenities such as wildlife and recreation for which all alternatives provide the greatest amount of benefits.

Alternative A (Current Alternative) This alternative has the highest cumulative PNV, with the greatest PV benefits in relation to PV costs. Recreation costs are low in this alternative and benefits are slightly higher than Alternatives C and D. Timber benefits are highest in this alternative and timber costs are second highest of all alternatives. The range in variation compared to the other alternatives is 4 to 10 percent. Overall, this alternative ranks first in terms of total PNV as well as first in terms of total PV benefits and second in PV costs.

Alternative B This alternative has the lowest total PNV including the lowest PV benefits and costs. This is primarily the result of having large amounts of custodial land not managed for timber. This alternative is 10 percent different in total PNV compared to the current Alternative A. Recreation and wildlife benefits are fairly high in this alternative because of the emphasis of focusing on high value return activities. Overall, this alternative ranks fifth in terms of total PNV, fifth in terms of total PV benefits, and fifth in PV costs.

Alternative C This alternative has an emphasis on ecosystem management and creating and maintaining wildlife habitats through restoration. This alternative has the highest wildlife costs and second highest wildlife benefits of all alternatives. Overall, this alternative ranks third in terms of total PNV as well as third in terms of total PV benefits and PV costs.

Alternative D This alternative provides the fourth highest total PNV. While in terms of total benefits this alternative ranks fourth, it has the greatest total costs. This high cost

is primarily due to this alternative's emphasis on increased timber production. Overall, this alternative ranks fourth in terms of total PNV, second in terms of total PV benefits, and first in PV costs.

Alternative E (Preferred Alternative) This alternative (with its emphasis on a variety of recreation uses, ecosystem management, and forest health) ranks second in terms of total PNV, fourth in terms of total PV benefits, and fourth in PV costs. Although this alternative ranks lower than Alternative A in total PNV, it represents a more balanced multiple-use alternative addressing all the major issues.

Table 3-228: Cumulative Decadal Present Values from 1st to 5th Decade for Benefits and Costs (Thousands of 2005 Dollars, 4% Discount Rate, Discounted To Mid-point of Each Decade).

Present Values Benefits and Costs	Alternatives				
	A	B	C	D	E
Present Value Benefits by Program					
Range	$336	$336	$336	$336	$336
Timber	$2,519,604	$1,892,149	$2,207,912	$2,476,937	$2,102,416
Minerals	$4,995	$5,113	$4,995	$4,995	$4,995
Recreation	$753,346	$772,276	$738,200	$746,580	$763,761
Wildlife	$329,348	$345,816	$336,922	$329,348	$335,935
PV of Benefits	$3,607,629	$3,015,690	$3,288,365	$3,558,196	$3,207,443
Present Value Costs by Program					
Range	$1,482	$1,482	$1,482	$1,482	$1,482
Timber	$1,896,833	$1,486,668	$1,659,343	$1,947,098	$1,561,022
Roads/Engineering	$319,530	$261,352	$306,770	$318,892	$290,659
Minerals	$4,855	$4,855	$4,855	$4,855	$4,855
Recreation	$26,788	$29,474	$29,474	$26,788	$32,137
Wildlife	$14,479	$14,629	$14,909	$14,479	$14,758
Soil, Water, Air	$15,123	$14,372	$15,424	$14,372	$15,274
Protection/Forest Health	$77,701	$78,474	$83,909	$78,474	$80,043
Lands	$11,514	$11,514	$11,514	$11,514	$11,514
Planning, Inventory, Monitoring	$6,445	$6,445	$6,445	$6,445	$6,445
PV Costs	$2,374,750	$1,909,265	$2,134,125	$2,424,399	$2,018,189
Cumulative Total Present Net Value					
Totals	$1,232,879	$1,106,425	$1,154,240	$1,133,797	$1,189,254

By maintaining a forest ecosystem, the OSFNFs provide the public with many valuable, non-market/non-priced resource benefits that are not considered in the PNV analysis. These benefits are not available (or are of limited availability) on other lands, particularly private lands. These include (1) a forested landscape with high visual quality, (2) clean water resources, and (3) habitat for a wide range of forest plant and animal species. These values also are most beneficial to recreation and wildlife, the resources that provide the most benefit to the Forest Service. In assessing these non-market/non-priced resource benefits according to acreage proposed for management

of these benefits (i.e., concentrated and dispersed recreation, watershed protection, scenic byways, and wildlife management) by alternative, Alternative A provides the most overall benefits, Alternative B provides the least benefits. Alternative E (preferred alternative) provides the second most overall benefits.

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, Arkansas' BMPs, 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 Forests 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.

In inventoried roadless areas, management activities that would maintain roadless character such as wildlife habitat manipulations and some associated temporary road construction, recreational trails, or other purposes could have an adverse effect on the potential future management of these areas as designated wilderness, as research natural areas, or for other purposes requiring natural characteristics.

Disturbance, displacement, or loss of fish and wildlife may occur because 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, Arkansas' 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 where roads are being built or maintained, management activities that include harvesting and removal of timber take place, 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 by designating more areas to either wilderness or allocations that would not be favorable to management activities. This practice 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 between Short-Term Uses and Long-Term Productivity

NEPA requires consideration of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures (including the financial and technical assistance) in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101)

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 Forests, 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 forest-wide management standards ensure that long-term productivity would not be impaired by the application of short-term management practices.

Each alternative 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 Forests' ecosystems is assured for all alternatives.

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 OSFNFs.

The management prescription areas 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 the revised Forest Plan.

Irreversible/Irretrievable Commitment of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line ROW or road. An irreversible commitment of resources results from a decision to use or modify resources that is renewable only over a long period, 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 Forest-wide 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 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.

Incomplete or Unavailable Information

The OSFNFs have 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 this chapter for each resource, where applicable. 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 Economic and Social Environment section identified the demographics of minorities and low-income populations and the environmental effects of the alternatives. There are no disproportionately adverse environmental or health effects to low-income or minority populations. Public involvement during plan revision was inclusive (refer to Appendix A–Summary of Public Involvement).

Environmental Justice Issues are typically found in connection with proposals having adverse environmental effects that may affect public health. Those kinds of effects are less likely in a forest plan decision because a plan revision does not normally include site-specific projects or effects.

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CHAPTER 4
LIST OF PREPARERS

PERSONS CONTRIBUTING TO PLAN

NAME/EDUCATION/EXPERIENCE	ROLE/RESPONSIBILITY
Cary J. Frost	
BS-Rangeland Science-Humboldt State University (1975). 30 years experience with US Forest Service at Ranger District and Supervisors Office levels on 2 National Forests and a National Grassland in 3 Forest Service Regions. 7 years experience in Land Management Planning.	Planning Team Leader (12/04 to Present), FEIS Team Leader, Recreation, Social Economic Analysis
Gary Knudsen	
BA-History-Graceland College (1974), MS-Anthropology-Florida State University (1980). 25 years of experience US Forest Service. Daniel Boone NF (Forest Archeologist), Ozark-St. Francis NFs (Forest Archeologist, Public Service/Administrative Officer, Public Services/Planning Staff Officer)	Planning Staff Officer, Interdisciplinary Team Member, Recreation, Heritage, NEPA
Sarah E. Melville	
BS-Natural Resources Management-Western Carolina University (1999). 5 years experience with US Forest Service (Gifford Pinchot NF, Southern Research Station, Chattahoochee-Oconee NFs, Ozark-St. Francis NFs).	Planning Team Member, Analyst, Silviculturist
Kathy A. King	
13 years experience with US Forest Service, Ozark-St. Francis NFs. Knowledge and understanding of several resource areas with on-the-job experience and training in Personnel, Recreation, Fire, Engineering, Public Affairs, and Planning. Continuing Education courses through Forest Service in job-related subjects.	Planning Team Member, Writer/Editor

NAME/EDUCATION/EXPERIENCE	ROLE/RESPONSIBILITY
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Steve L. Duzan	
BS-Wildlife Science-New Mexico State University. 24 years with US Forest Service. Worked on 2 National Forests, 6 Ranger Districts and an SO in Forest Planning, Wildlife Management, Recreation, Range Management, and Fire.	Planning Team Member, Wildlife Resources
Richard (Dick) Bowie	
BLA,-Landscape Architect-University of Oregon (1972). 30 years of experience with US Forest Service at Ranger District and Supervisors Office level on 7 National Forests in 3 Forest Service Regions. Experience includes Wilderness, Winter Recreation, Special Use permits, Lands, Trails, National Recreation Areas, and Forest Service Monuments.	Interdisciplinary Team Member, Landscape, Recreation Resources
Michael A. Crump	
BS Geology Mississippi State University (2000), MS Geology University of North Carolina at Wilmington (2002). 2 years experience with the US Forest Service, Trainee on Bankhead R.D. NF in Alabama, Hydrologist on Ozark-St. Francis NFs SO.	Interdisciplinary Team Member, Hydrologic Resources
Jack P Davis	
BS-Timber Management-Stephen F Austin University (1977). Forest Silviculturist, 27 years experience in Silviculture, Timber Management, and Planning.	Planning Team Member, Silviculturist, Analyst

Name/Education/Experience	Role/Responsibility
Thomas M. Falls	
BS-Civil Engineering-Oregon State University (1972). 25 years Forest Service experience in Transportation Planning and Preconstruction Engineering on 2 National Forests.	Interdisciplinary Team Member, Engineering
Roger D. Fryar	
BS-Forestry-Stephen F. Austin State University (1972), Continuing Ed-Botany and Ecology-University of Tennessee (1997-1998). 25 years experience in Forestry and Silviculture. 5 years experience in Ecology, Fire Management, and Emergency Management. Experience working in 3 National Forests in 3 states in Southern Region.	Interdisciplinary Team Member, Fire Resources
Carol Horn	
Associate's Degree-Arkansas Tech University, Continuing Education-Colorado State University and Ohio State University. 30 years experience with US Forest Service on Ozark-St. Francis National Forests. 17 years in Land and Minerals as land appraiser and realty specialist.	Interdisciplinary Team Member, Lands and Minerals
Deryl D. Jevons	
BS- Forest and Range Management-Colorado State University (1971). 32 years experience with US Forest Service at Ranger District and Supervisors Office levels on 5 National Forests in 2 Forest Service Regions. 14 years experience in Land Management Planning.	Planning Team Leader (left OSFNFs in 12/04).
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PhD-Anthropology-Southern Methodist University (2001). 33 years experience mid-continental and southeastern North America with specialties in Archival Research, Geoarchaeology, Environmental Reconstruction, and Dendrochronology. 9 years FS experience on 5 National Forests; and Wildland Fire Suppression across North America.	Interdisciplinary Team Member, Heritage Resources

Name/Education/Experience	Role/Responsibility
Ron Klouzek	
BS-Civil Engineering-University of Missouri at Rolla. 28 years experience with US Forest Service working at Ranger District and Supervisor's Office levels on 6 National Forests, 2 National Grasslands, and 1 National Recreation Area in 4 Regions.	Interdisciplinary Team Member, Engineering, Lands and Minerals
Kim Mortenson	
BS-Forestry-University of Minnesota. 10 ½ years experience with Bureau of Land Management as a cadastral land surveyor; 17 years experience with US Forest Service as hotshot, registered land surveyor, and wide spectrum of duties in Land and Minerals (land surveying, special uses, right-of-way acquisitions, minerals administration, title claims).	Interdisciplinary Team Member, Lands and Minerals
Tim Mersmann	
BSFR.-Timber Management and Wildlife Biology-University of Georgia (1985); MS-Wildlife Science-Virginia Tech (1989); 15 years experience with US Forest Service in the Southern Region; 5 years experience in the Southern Regional Office working on integrating biological conservation within Forest Service planning processes.	Regional Planning Biologist
John C. Nichols	
BA-Geology (1975). 1 year graduate work. Forest Geologist and Minerals Program Manager (Ouachita National Forest). 34 years federal service (30 with the FS and 4 in the US Navy). FS Certified Mineral Examiner. Program Manager for minerals program on Ouachita NF in Arkansas and Oklahoma (20 years) and Nezperce NF in Idaho (5 years).	Interdisciplinary Team Member, Geologic Resources
Ralph R. Odegard	
BS-Fisheries and Wildlife Management-Arkansas Tech University (1973). 27 years of experience with US Forest Service working on 4 districts as District Biologist and Supervisors Office as Forest Wildlife Biologist.	Interdisciplinary Team Member, Wildlife and TES Resources

Name/Education/Experience	Role/Responsibility
Ronald D. Rambo	
BS-Fish and Wildlife Management-Arkansas Tech University; MS-Zoology (emphasis on Fisheries)-University of Arkansas. Conducted research on effects of various land-use practices on smallmouth bass population dynamics and fish assemblages in Boston Mountain streams in Arkansas. 3 Years experience as Fisheries Biologist on the Boston Mountain and Magazine Ranger Districts on Ozark-St. Francis NFs. 7 years experience as District Wildlife biologist on the Ozark-St Francis and Mark Twain NFs (Was responsible for District Fisheries Program.)	Interdisciplinary Team Member, Fisheries, Aquatic TES, Aquatic Viability
Tina C. Rotenbury	
BS Park Administration, Arkansas Tech University (1991). 15 years government service, 1 year Corps of Engineers, 14 years US Forest Service. Worked on Ouachita National Forest for 6 years. Came to Ozark–St. Francis National Forests in 1997 as district resource clerk, joined GIS staff in SO 6 years ago.	Interdisciplinary Team Member, GIS
Jan Self	
BA-Drama and Speech-Birmingham Southern College (1973), BS-Fisheries and Wildlife Management-Arkansas Tech University (1990). 30 years working in Natural Resource Management field with National Park Service and US Fish & Wildlife Service and US Forest Service.	Interdisciplinary Team Member, Wildlife and Range Resources
J. Keith Whalen	
BS-Forestry (Fisheries Option)-Virginia Tech, MS- Biology-James Madison University. 6 Years experience in Fisheries & Aquatic Research at Southern Research Station–Center for Aquatic Technology Transfer (CATT) Team working on projects in Regions 8 & 9. Detailed last two years with US Forest Service National Aquatic Ecology Unit.	Interdisciplinary Team Member, Fisheries, Aquatic TES, Aquatic Viability

Name/Education/Experience	Role/Responsibility
Marvin L. Weeks	
BA-Geography-Florida State University (1975). 25 years as soil scientist with the US Forest Service at Ranger District and Supervisors Office levels on 3 National Forests in the Southeast Region. 1 year as soil scientist with the SCS. in Florida, 1 year as Engineering Technician with the Florida Department of Pollution Control.	Interdisciplinary Team Member, Soils Resources

CHAPTER 5
FEIS DISTRIBUTION LIST

FOREST PLAN MAILING LIST

Individuals

1318 Citizens

Native American Contacts

Absentee-Shawnee Tribe of Indians of Oklahoma
Caddo Indian Tribe of Oklahoma
Cherokee Nation of Oklahoma
Chickasaw Nation of Oklahoma
Choctaw Nation of Oklahoma
Delaware Tribe of Indians
Eastern Shawnee Tribe of Oklahoma
Osage Tribe
Quapaw Tribe of Oklahoma
Seminole Tribe
Shawnee Tribe
Tunica-Biloxi Tribe of Louisiana

Organizations

American Motorcyclist Association
Arkansas Canoe Club
Arkansas Canoe Club-Piney Chapter
Arkansas Chapter of Missouri Fox Trotting Horse Breeding Association
Arkansas Department of Parks and Tourism
Arkansas Dirt Riders
Arkansas Farm Bureau
Arkansas Game & Fish Commission
Arkansas Highway & Transportation Department
Arkansas Horse Council
Arkansas Hospitality Travel Council

Arkansas Mule Riders/Arkansas Trails Council
Arkansas Natural Heritage Commission
Arkansas Natural Scenic Rivers Commission
Arkansas Nature Conservancy
Arkansas River Coalition
Arkansas River Valley Dirt Riders
Arkansas Squirrel Hunters
Arkansas Trail Riders Association
Arkansas Trails Council
Arkansas Wilderness Steering Commission
Arkansas Wildlife Federation
Arkansas Bicycle Club
ATU Chapter FWS
Audubon Society
Back Country ATV Trail Riders
Backwoods
Bear Creek Lake Association
Bicycle Coalition of the Ozarks
Biodiversity Legal Foundation
Boston Mt. Cyclists
Buffalo River Backcountry Horsemen
Buffalo River Real Estate
Clifty Riding Club
Cowgirl Up
Crawford Ranch
Dogwood Alliance
Ducks Unlimited
East Arkansas Wildlife Association
Equestrian Unlimited
Forest In Holder Guardian
Forest Stewardship Council
Friends of Lake Wedington
Friends Of St Francis
Friends Of White Rock
Green Country Cruisers
Harrison Roundup Club
Harrison Round-Up Club
Heartwood
Hot Springs Bicycle Association
Joy Riders
Kansas City Climbing Club

League Of Women Voters
Mena Nature Club
Mercy Cycling Team
Missouri Wilderness Coalition
Missouri Fox-Trotting Arkansas Chapter
National Museum of Natural History
National Wild Turkey Federation
National Wildlife Federation
National Off-Highway Vehicle Conservation Council
Newton County Wildlife Association
North Arkansas Medical Center
Odyssey Adventures
Ouachita Jeep Jamboree
Ozark Mountain Paddlers Canoe Club
Ozark Folk Center
Ozark Highlands Trail Association
Ozark Interpretive Association
Ozark Mountain Bike Patrol
Ozark Off Road Cyclists
Ozark Society
Ozark Watch League
Ozark Electric Coop Corporation
Pacific Legal Foundation
Pacific Rivers Council
Patterson Hardwoods
Pierce Stanley and Robinson
Quail Unlimited
Razorback Riders Motorcycle Club
River Valley Dirt Riders
Rock Crawlers 4x4 Club
Rocky Mountain Elk Foundation
Russellville Riders
Sassafras Knob Ranch
Sierra Club
Takahik River Valley Hikers
The Nature Conservancy
The Wilderness Society
The Wildlife Society
Twin Lakes Bicycle Club
Western Arkansas Planning & Development District
Wilderness Watch

Wildlife Management Institute
Yell County Wildlife Federation

Business/Industry

Arkansas Power and Light
Allstate Timber Products, Inc.
American Forest & Paper Association
Arkansas Land and Timber Company
Arnold & Sons, Inc.
B & L Lumber
Bibler Brothers
B-K Farms
Boling Brothers
Branscum & Harness Lumber Co
Byrds Adventure Center
Campbell & Sons
Canal Wood Corp Of Arkansas
Canino & Associates, Inc.
Clarksville Wood Products, Inc.
Crouch & Associates
Curtner Lumber Company
Davis Petroleum Services
Dawson Trucking Inc
Deltic Timber Corporation
Easterling Wood Products
End-Time Handmaidens Inc
Family Garden Nursery
Faust Band Saw Mill, Inc.
Flake & Kelley
Flud's Sawmill
Foothold Farm
Forest Conservation Council
Forest Pest Management
Forest Siding Supply
G R Wood Inc
Georgia Pacific Corp.
Gibbons Law Firm
Gillihan Wood Products
Green Bay Packaging, Inc.
Gregory Farms
H E R Lumber
Hankins General Store

Harrison Suzuki
Hayes Oak
Hidden Valley Timber Co
Hudson Wood Products
Hudspeth Sawmill
Hughes Lumber Company
J & J Logging
J R Banks Lumber Co Inc
James D Younger Sawmill, Inc.
Kings River Wood Products, Inc.
Kingston Sawmill
Kingwood Forestry Services, Inc.
Knight Timber Products
L & L Wood Products
Lane Brothers
Lizark Springs Lodging
Locust Thicket Enterprises
Love Box Company
Mack's Pines
Miller-Patterson
Mills Oil Company
Moore Forest Products, Inc.
Moorman Association
Morning Star Sawmill
Mountain View Farms
Northwest Hardwoods
Nulyne, Inc
Oark General Store
Offutt Enterprises
Ola Wood Yard, Inc.
Ouachita Timber Purchasers Group
Ozark Gas Pipeline Corp
Ozark Outdoor Supply
Ozark Timber Treating, Inc.
P & L Logging
Pack Rat Outdoor Center
Perry County Headlight
Petit Jean Country Headlight
Plum Creek Timber
Post Family Vineyards
Prairie Grove Enterprises
R E Short Farm
Ransom Logging, Inc.

Richard's Honda
Ricketts Sawmill
Ridgewood Timber Corp
Sherman's Dozer
Southeastern Lumber Mgt Association
Southern Wood Services
Southwestern Power Administration
Sullivan Lumber Company
T & K Lumber Co Inc
T & S Sawmill
Travis Lumber Company Inc
Treat Wood Products
Yamaha of Harrison, Inc.
Wallace & Associates
Weyerhaeuser
Willhite Forest Products, Inc.

Libraries

Arkansas River Valley Regional Library
Beebe Public Library
Central AR Library System
Conway County Library
Faulkner County Library
Fayetteville Public Library
Forrest City Public Library
Fort Smith Public Library
Lee County Library
Newton County Public Library
North AR Regional Library
Phillips County Library
Pittsburg State University
Pope County Regional Library
Quinney National Resources Library
Ross Pendergraft Library
Springdale Public Library
Stone County Library
Texarkana Public Library
UAPB Watson Memorial Library
University of The Ozarks Library
Westark Community College Library
White River Regional Library

Local/Regional Government Entities

Baxter County Judge
Benton County Judge
City of Fort Smith
City of Marianna
City of Pottsville
Conway County Judge
Crawford County Judge
Delta Cultural Center
Franklin County Judge
Johnson Co Chamber Of Commerce
Johnson County Judge
Lee Co Chamber Of Commerce
Lee County Judge
Logan County Judge
Madison County Judge
Marion County Judge
Mayor Of Jasper
Newton County Judge
Ozark Chamber Of Commerce
Parthenon Voluntary Fire Dept.
Phillips County Judge
Pope County Coop Ext Svc
Pope County Judge
Searcy County Judge
Searcy County Land Use
Sebastian County Judge
Stone County Judge
Van Buren County Judge
Washington County Judge
Yell County Judge

State Government Agencies

Arkansas Archeological Survey
Arkansas Department of Environmental Quality
Arkansas Department of Highway & Transportation
Arkansas Department of Parks & Tourism
Arkansas Forestry Association
Arkansas Forestry Commission

Arkansas Game & Fish Commission
Arkansas Geological Commission
Arkansas State Plant Board
Coop Extension Service In Little Rock
Crawford County Coop Extension Service
Department of Parks & Tourism
Devil's Den State Park
Franklin County Coop Extension Service
Johnson County Extension Office
Madison County Coop Extension Service
Newton County Coop Extension Service
Pope County Coop Extension Service
State Clearing House
University of Arkansas Coop Extension Svc
Washington County Coop Extension Service

Federal Government Agencies

USDI Buffalo National River
US EPA Region VI
USDI Fish & Wildlife Service-Oklahoma
USDA NF Mark Twain
USDI National Park Service
USDA NF Ouachita
Public Lands Office
US Department of Army Corps Of Engineers
US Department of the Interior
US Environmental Protection Agency
USDI Fish & Wildlife Service
USDA Animal Damage Control
USDA Ozark-St. Francis National Forests

Elected Officials

Governor Mike Huckabee
Honorable Blanche Lincoln
Honorable John Boozman
Honorable Mark Pryor
Honorable Mike Ross
Honorable Vic Snyder

Honorable Marion Berry

Education

Arkansas State University
Arkansas Tech University
Hendrix College
Tennessee Tech University
University of Arkansas
University of Arkansas Libraries-Serial Dept.
University of Arkansas -Biological Sciences
University of Arkansas -Geosciences
UAM-School of Forestry
University of Central Arkansas
Wild Rockies Field Institution

Media

Arkansas Democrat Gazette
Arkansas Times Magazine
Associated Press
Harrison Daily Times
Johnson County Graphic
KARV Radio
KDYN Radio
KETS-TV
KLYR
KNEA
KRLW/KCAZ
KSAR
KTHS/KSCC
KVOM
KWYN Radio
Log Cabin Democrat
Marshall Mountain Wave
Morning News
Mountain Echo
Newton County Times
Northwest Arkansas Times
Ozark Spectator

Paris Express - Progress
Phillips County Progress
Press Argus-Courier
Southwest Times Record
Stone County Citizen
Stone County Leader
The Atkins Chronicle
The Courier
The Daily Citizen
The Daily World
The Herald-Leader
Van Buren County Democrat
Washington County Observer

CHAPTER 6
GLOSSARY

ACRONYMS

A

AA - analysis area
ABB – American burying beetle
ACP – Agriculture Conservation Program
AD - Administratively Determined
ADA - Americans with Disabilities Act
ADEQ – Arkansas Department of Environmental Quality
AGFC – Arkansas Game & Fish Commission
AHC – Arkansas Heritage Commission
AMS - Analysis of the Management Situation
ANH – Arkansas Natural Heritage
APCEC – Arkansas Pollution Control and Ecology Commission
APHIS - Animal and Plant Health Inspection Service
AQRV – Air Quality Related Values
ASWCC – Arkansas Soil and Water Conservation Commission
ASQ - allowable sale quantity
ATV – all-terrain vehicle
AUM - animal unit month

B

BA - basal area
BBS – Breeding Bird Survey
bf - board foot
BLM – Bureau of Land Management
BMP - best management practice
BIO – biological oxygen demand
BSS - base sale schedule

C

°C – degrees Celcius
CAA - Clean Air Act
CCC – Civilian Conservation Corps
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
CHBCR – Central Hardwoods Bird Conservation Region
CIP - Capital Investment Program
CISC - Continuous Inventory of Stand Conditions
CMAI - culmination of mean annual increment
COMPATS - Computerized Project Analysis of Timber Sales
CUA – Concentrated Use Area
CVHW - cove hardwood
CVMM – Common Variety Mineral Materials
CWA - Clean Water Act
CWD– coarse woody debris

D

dbh - diameter at breast height
DBRU - Drainage Basin Response Unit
DEIS - Draft Environmental Impact Statement
DFC - desired future condition

E

EA – Environmental Assessment
EBLIs – Expanded Budget Line Items
ECOMAP - Ecological Classification and Mapping Task Team
ECS - Ecological Classification System
EF – Experimental Forest
e.g., – for example
EIS - Environmental Impact Statement
EMU - Ecological Management Unit
EPA - Environmental Protection Agency
ESA - Endangered Species Act
et al. – and others
EWAP – East-Wide Watershed Assessment Protocol
EWPP- Emergency Watershed Protection Plan

F

°F – Fahrenheit
FA&O – Facilities-Administrative and Others
FDR - forest development road
FEIS - Final Environmental Impact Statement
FH - Forest Highway
FIA - Forest Inventory and Analysis
FLPMA – Federal Land Policy and Management Act
FMAP - Fire Management Action Plan
FR - Forest Road
FRCC – Fire Regime and Condition Classes
FRI – fire return interval
FRP - Forest Road Program
FSH - Forest Service Handbook
FSM - Forest Service Manual
FTE - full-time employee
FY - fiscal year

G

GAO - Government Accounting Office
GFA – General Forest Area
GIS - Geographic Information System
GLO – General Land Office
GPD - gross domestic product
gpm – gallons per minute

H

HFI – Healthy Forest Initiative
HFRA – Healthy Forest Restoration Act
HRP - Human Resource Program
HUC – Hydrologic Unit Codes

I

IBI – Index of Biotic Integrity
IDT - Interdisciplinary Team
i.e. – that is
IMPROVE – Interagency Monitoring of Protected Visual Environments
IFD – Industrial Facilities Discharge
IPM - integrated pest management
IS - Interpretive Services
IWI – Index of Watershed Indicators

K

km – kilometer

L

LAR - Land Area Report
LE - law enforcement
LOAS – Land Ownership Adjustment Strategy
LRMP – Land and Resource Management Plan
LTA - landtype association
LTP - landtype phase
LTSYC - long-term sustained-yield capacity
LUG - land-use group
LWCF - Land and Water Conservation Fund
LWD – large woody debris

M

m - thousand
m$ - thousands of dollars
MA - management area

MAR - Management Attainment Report
MAUM - thousand animal unit month
MAV – Mississippi Alluvial Valley
MBF - thousand board feet
MCF - thousand cubic feet
MIL - management intensity level
MIS - management indicator species
ML – Maintenance Level
MM - million
MM$ - millions of dollars
MMBF - million board feet
MMCF - million cubic feet
MMR - minimum management requirement
MMRVD - million recreation visitor-day
MOA – memorandum of agreement
MOU - memorandum of understanding
MRVD - thousand recreation visitor-day
MWFUD - thousand wildlife and fish user-day

N

NAAQS - National Ambient Air Quality Standards
NADP – National Acid Deposition Program
NAPAP – National Acid Precipitation Assessment Program
NAWQA – National Water Quality Assessment
NBIS – National Bridge Inspection Standards
NEPA - National Environmental Policy Act
NF - National Forest
NFS – National Forest System (lands)
NFMA - National Forest Management Act
NFP – National Fire Plan
NFRS – National Forest Recreation Survey
NFS – National Forest System
NFSR – National Forest System Road
NHPA – National Historic Preservation Act
NIFP – Non-industrial Private Forest
NOAA – National Oceanic and Atmospheric Agency
NO_3^1 - nitrates
NOx – nitrogen oxides
NPL – National Priorities List
NPS – National Parks Service
NRCS - Natural Resources Conservation Service
NRI – Natural Resource Inventory
NRIS – Natural Resource Information System
NRSE – National Survey on Recreation and the Environment
NSO – no surface occupancy
NTMB - Neotropical migratory birds
NVUM – National Visitor Use Monitoring
NWF – National Wildlife Federation
NWPS - National Wilderness Preservation System

O

O_3 - ozone
OHV - off-highway vehicle
OMP - operation maintenance and protection
OOHA – Ozark-Ouachita Highlands Assessment
OOPP – Ozark-Ouachita Physiographic Province
ORV - off-road vehicle
OSFNF – Ozark-St. Francis National Forests

P

P - Primitive
PAOT - persons-at-one-time
PCS – Permit Compliance System
PD – public domain
PETS - proposed, endangered, threatened, or sensitive
PFSR – Public Forest Service Road
PIF – Partners in Flight
PILT – Payment in Lieu of Taxes
PL - public law
PM - particulate matter
$PM_{2.5}$ – particulate matter, 2.5 microns and smaller
PM_{10} – particulate matter, 10 microns and smaller

PNV - present net value
PNW - present net worth
ppm – parts per million
PSD - prevention of significant deterioration
psi - pounds per square inch

R

R - Rural
RAP – Roads Analysis Process or Procedure
RARE I - Roadless Area Review and Evaluation
RARE II - The Second Roadless Area Review and Evaluation
RBP – Rapid Bioassessment Protocol
RCRIS – Resource Conservation and Recovery Information System
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
RN – Roaded Natural
RNA - research natural area
ROD - record of decision
ROS - Recreation Opportunity Spectrum
ROW - right-of-way
RRPA – Renewable Resources Planning Act
RVD - recreation visitor-day

S

SAA - Southern Appalachian Assessment
SCORP - State Comprehensive Outdoor Recreation Plan
S&G - standard and guideline
SH - state highway
SHPO – State Historic Preservation Office
SIA – Special Interest Area
SIC – Standard Industrial Code
SIO – Scenic Integrity Objective
SIP - State Implementation Plan
SMS – Scenery Management System
SMZ – Streamside Management Zone
SO_2 – Sulfur Dioxide
SO_4^2 - Sulfates
SPB - southern pine beetle
SPM – semi-primitive motorized
SPNM – semi-primitive non-motorized
SRS – Southern Research Station
SVE – Species Viability Evaluation
SWAP – Source Water Assessment Program

T

TES – threatened, endangered, and sensitive species
TNC - The Nature Conservancy
TSI - timber stand improvement
TSL – Traffic Service Level
TSPIRS - Timber Sale Program Information Reporting System

U

U – Urban
$\mu g/m^3$– micrograms per cubic meter
UPLD - upland hardwood/mixed
USC - United States Code
USDA - U.S. Department of Agriculture
USDI - U.S. Department of Interior
USFS – U. S. Forest Service
USFWS - U.S. Fish and Wildlife Service
USGS - U.S. Geological Survey

V

VAB – Value, Attitude, and Beliefs
VIS - Visitor Information Services
VMS – Visual Management System
VOC - volatile organic compounds
VQO - visual quality objective

W

WFUD - wildlife and fish user-day
WHI - wildlife habitat improvement
WIN - Watershed Improvement Inventory

WMA – Wildlife Management Areas
WO - Washington Office
WRD - Wildlife Resources Division
WRP – Wetlands Reserve Program
WSRFEIS – Wild and Scenic River Study Report and Final Environmental Impact Statement
WURR – Water Use Rights and Requirements

Y

YBP – years before present
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 Ozark-St. Francis National Forests. (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 Ozark-St. Francis National Forests. (Referred to as Timber Staff)

USDA Forest Service, *Final Environmental Impact Statement for the Ozark-St. Francis 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 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 particulate matter containing high concentrations of sulfuric acid, nitric acid, or hydrochloric acid, 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 acid-combining capacity of a water sample as determined by titration with a strong acid. Acid neutralizing capacity includes alkalinity (carbonate) and other basic chemicals.

acidification – To convert into an acid or become acid.

Agriculture Conservation Program – USDA cost-share program for streambank 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 (separated) 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 - 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 (AMS) - 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, semi-permanently, 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 in-stream 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

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 practices (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.

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 70ºF, and exhibit their greatest reproductive success at temperatures below 65ºF (18.3ºC).

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 (CISC) - 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) stipulation - Allowed use and occupancy (unless restricted by another stipulation) with identified resource values requiring special operational constraints that may modify the lease right

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 or architectural in nature. Cultural resources are non-renewable.

c-unit - 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.
desired landscape character - Appearance of the landscape character to be retained or created over time, recognizing that a landscape is a dynamic and constantly changing community of plants and animals. It includes the combination of landscape design attributes and opportunities, and biological opportunities and constraints.
developed recreation - Recreation use or opportunities occurring at developed sites.
developed recreation site - Relatively small, distinctly defined area where facilities are provided for concentrated public use. Examples include campgrounds, picnic areas, and swimming areas.
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. Examples are camping and picnicking.
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 destruction (e.g. wildfire), or the vegetation in the area.

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 (EMU) - 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 (EIS) - 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.

evapotranspiration - 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 wilderness - Those areas already designated as wilderness by Congress. There are five such areas on the forests—East Fork, Hurricane Creek, Leatherwood, Richland Creek, and Upper Buffalo..

extirpation – Extinction of a species from all or 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 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 regime condition class (FRCC)– 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 use – The combination of wildland fire use and prescribed fire application to meet resource objectives.

fisheries classification - Water bodies and streams classed as having a cold- or warm-water fishery. This designation is dependent upon the dominant species of fish occupying the water.

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.

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.

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 (GIS) - 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.

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

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.
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 (ID) 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.

land type - An intermediate level in the ecological classification system based on landform, natural vegetative communities, and soils.

land type 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.

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 during which the age of trees is usually more than 80 years depending on the composition of tree species. Small gaps become more common as some trees die allowing full sunlight to reach the mid- and understories. This stage contains the largest trees within a forest and provides the highest capability for large snags, large live cavities, and den tree production. The presence of large, downed, woody material is highest during this period. Old-growth forests occur during the later periods of the seral 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.

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 issues 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.

mid-serel (successional) stage – The state of forest development during which distinct overstory, midstory, and understory canopies are present. The age of trees range from about 20 to 90 years depending on the composition of tree species. The trees are usually more than 10 inches in dbh. This stage provides capability for hard mast production, large standing snags, and live cavities. During this period, tree species reach economic maturity.

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.

modification - A visual quality objective in which human activity may dominate the characteristic landscape but must, at the same time, use naturally established form, line, color, and texture appearing as a natural occurrence when viewed in foreground or middle ground.

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, motorboats, 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 Visitor Use Monitoring - 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.

no surface occupancy (NSO) stipulation – A fluid mineral leasing lease stipulation that prohibits occupancy or disturbance on all or part of the land surface to protect special values or uses. Lessees may access the oil and gas or geothermal mineral resources under leases restricted by this stipulation through use of directional drilling from sites outside the NSO area.

non-chargeable 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.

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 - 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

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.

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 (ROD) - 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 Information Management (RIM) - A computerized system for gathering and storing national forest recreation information for purposes of resource planning, management, and research.

Recreation Opportunity Spectrum (ROS) - 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)** – Area characterized by having essentially unmodified natural environment of 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)** - 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. Motorized use is not permitted.

- **Semi-Primitive Motorized (ROS)** - 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. Motorized use is permitted.
- **Roaded Natural (ROS)** - 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. Construction standards and design of facilities provide for conventional motorized use.
  The recreation opportunity experience level provided is 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)** - 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.
  Experiencing natural environments, having challenges and risk afforded by the natural environment, and the use of outdoor skills is relatively unimportant. Opportunities for competitive and spectator sports and for passive uses of highly human-influenced parks and open spaces are common.

reforestation – The re-establishment of forest cover by seeding, planting, and natural means.

regeneration - The act of renewing 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 and islands that comprise the Southern Region of the USDA Forest Service. They are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, Virgin Islands, and Virginia.

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 silvicultural 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 (cultivation), aeration, and permeability.

river classifications

> **(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** – Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

road – A motor vehicle path more than 50 inches wide, unless classified and managed as a trail. It may be classed as a system or non-system road.

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. This refers to the second such assessment that was 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

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.
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 (SMS) - 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.
scenic integrity objective (SIO) - 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.
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 (1) have appeared in the *Federal Register* as proposals for classification, and are under consideration for official listing as endangered or threatened species; (2) are on an official state list, or (3) are recognized by the Regional Forester to need special management to prevent the need for their placement on federal or state lists.

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 over wood.

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, co-dominants, 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. Most commonly used for resource protection, public safety, or addressing an issue.

standard lease stipulation - Applied to all leases and provides basic direction and details on authorized officers administering the lease.

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.

stipulation – A provision that modifies standard lease rights and is attached to and made a part of the lease.

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 (SMZ) - 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 stage or recognizable condition of a plant community that occurs during its development from bare ground to climax: grass, forb, shrub seedling, pole-sapling, immature, mature, old growth.

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.
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 basin-wide 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 round wood.

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.

variety class - A classification system for establishing three visual landscape categories according to the relative importance of the visual features. This classification system is based on the premise that all landscapes have some visual values, but those with the most variety or diversity of visual features have the greatest potential for high scenic value.

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. Except for "preservation," each goal describes a different degree of acceptable alteration of the natural landscape based on the importance of esthetics.

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, estuarine, and marine systems.
wild and scenic river - A river or section of river designated as such by congressional action under the Wild and Scenic Rivers Act of Oct. 2, 1968, as supplemented and amended, or those sections of a river designated as wild, scenic, or recreational by an act of the legislature of the state or states through which it flows.
wilderness - All national forest lands included in the National Wilderness Preservation System. An area where the earth and its community of life are untrammeled and only visited by humans.
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 wild lands 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 (WFUD) – 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.

withdrawal – 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.

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.

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